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AMERICAN FERN SOCIETY

EDITORS

C. V. MORTON

R. C. BENEDICT

IRA L. WIGGINS

A. C. SMITH

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American Fern Journal

VOL. 46

JANUARY-MARCH, 1956

No. 1

Models for Spore Study¹

MAUD MARY GRISWOLD

WHY MODELS?

The main purpose of the study of spore models at Mistaire Laboratories² has been to help us learn as much as we can about the true shape and characteristics of fern spores. Because spores are so minute, they are difficult to examine; and as a result there are some aspects which are only vaguely understood, and others about which there is definite disagreement. Spores need to be studied by several different methods; and models have proved to be a valuable and interesting approach. As tangible, three-dimensional objects, they can help overcome the limitations of microscopic work—they can be handled, experimented with, and talked about. Models are both a means and an end. They are both an important tool for learning and a useful tool for teaching.

APPROACH

Our first approach was theoretical—a study of spores as purely geometric forms. It was not to be influenced by preconceived ideas or based on previous microscopic experience. We analyzed shapes and lines, experimented with variations from the standard forms, and then turned

¹ A talk given at the symposium on fern spores at Mistaire Laboratories, Millburn, New Jersey, June 4, 1955.

² The work on spore models was begun by Carolyn Corey and Marilyn Dumper in 1945. It has been continued by others working under Miss Hires' direction since then.

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to actual spores and spore photographs to compare with our theoretical spores.

The second approach was the reverse. Specific spores and their distinguishing details were studied carefully with the microscope, and then models of what we saw were made to help clarify our ideas, and if possible to verify them.

PHASES OF STUDY

Spores come packaged in groups of four (tetrads) and the questions were: What shape was the original mother cell?, and in what manner does it divide? The shapes of the individual spores would, of course, be directly determined by these two factors. Two types of tetrad division are most commonly described. The first is like an apple being cut into four equal parts; the single central line where the four spores were joined gives them the designation monolete, or "one scar." In the second type, the four spores meet at the central point of the tetrad; from that point, three lines on each spore mark where it has separated from the others, giving therefore the name trilete, or "three scars." We experimented with both spheres and non-spheres as possible shapes for the mother cell, dividing them by these two methods. The non-spherical cells, we discovered, yielded asymmetrical shapes in most cases.

More lengthy studies were made of single whole spores of both monolete and trilete types. The shapes used as the standards for these were based on a divided sphere. First, these standards were studied to see what, and how many, *apparent* variations of shape could occur because of the angle of view. This type of analysis corresponds to viewing spores under low magnification. Then we made monolete and trilete models with *actual* variations from the standards—rounded edges, bulbous or indented areas, and variations of the scar ridges. Some kinds of

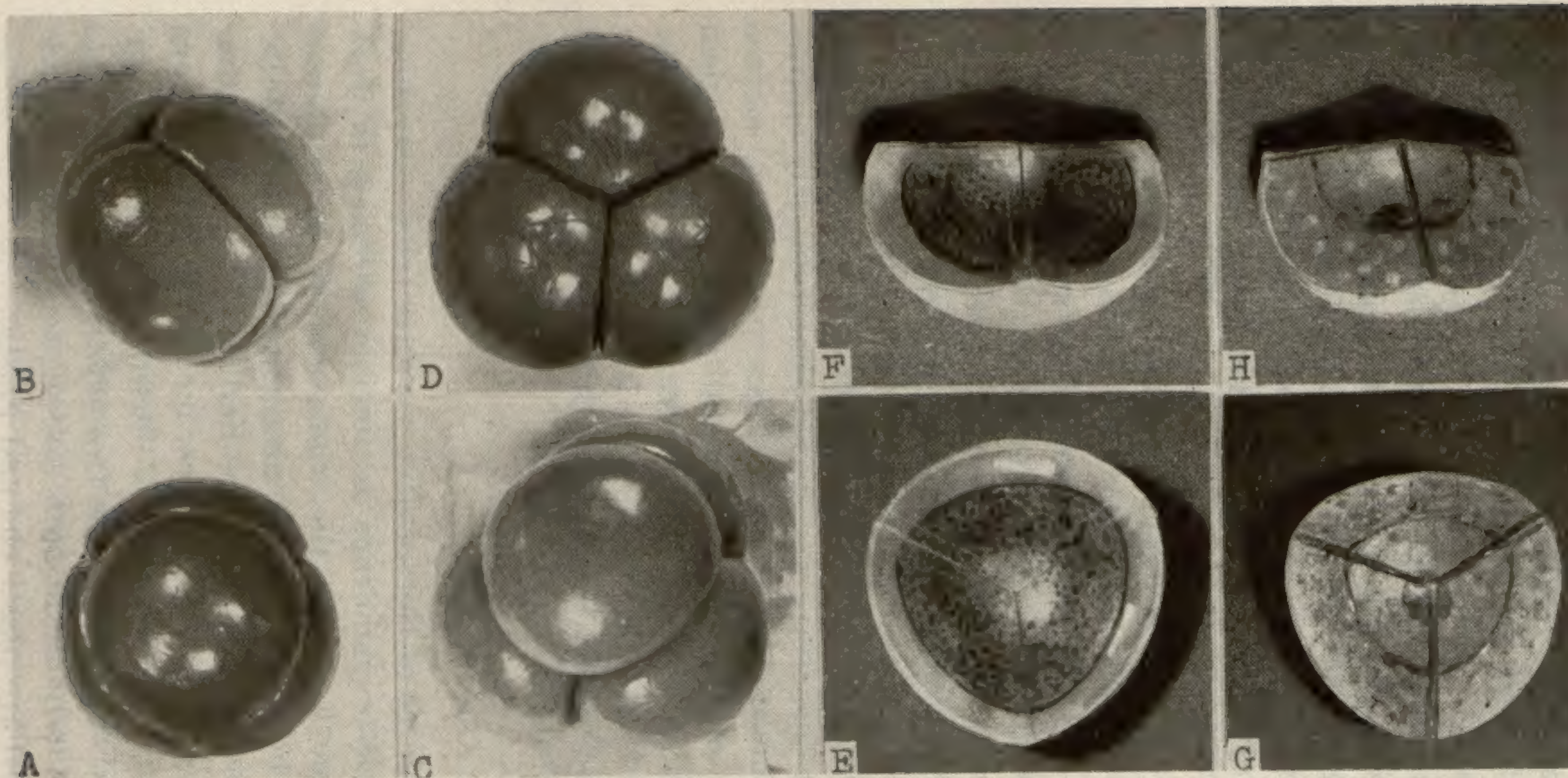
spores change noticeably after they separate from each other and begin to mature, and we tried to think of changes which theoretically were likely to occur.

Cross-sectioned models were another phase of study. These models imitate the effect of examining the spores under high magnification, focussing from the top surface to the bottom. A surprising number of different shapes may occur within a single model at different levels. Concentration on the shape of a single focus could be very misleading and distort one's interpretation. The same caution must be used in studying sectioned models as in studying photographs of spores seen under high magnification. Each shape must be thought of in its relation to the next and preceding shape in the series; and the *whole* spore must always be kept in mind.

Study of details of surface and structure by means of models has been our final area of concentration. The models for this study were based almost entirely on preliminary microscopic work. Ridges, projections, surface markings, and patterns were all observed and then copied. It is difficult to be certain about fine details. Light effects greatly confuse the issue, and the slightest shift of focus-level gives quite different impressions of the same feature.

MATERIALS AND METHODS

In the course of this project, we have tried everything from plastic to gumdrops as possible materials to work with. None has been the whole answer, but different ones can be valuable for producing different effects. Those which are opaque are limited to demonstrating spore shape and external appearance. The few which are transparent may be used to illustrate the internal appearance of the spore. The two most practical materials from the standpoint of both ease of use and permanence of the model are plasticene and plastic.



MODELS OF TRILETE SPORES, TWO POSITIONS EACH

A, B, C, D, PLASTICENE TETRADS: A, B, SPORES AS SPHERES; C, D, SPORES BULBOUS BEYOND SPHERES. E, F, G, H, PLASTIC SPORES: E, F, CHLOROPLASTS AT INNER CYTOPLASMIC BOWL SURFACE (E, GREEN CENTER, YELLOW EDGE; F, GREEN AREA ALONG SPORE EDGE); G, H, CHLOROPLASTS THROUGH CYTOPLASMIC BOWL (G, CENTRAL NUCLEUS; H, OFF-CENTER NUCLEUS)

The ever-pliable plasticene can readily be shaped or reshaped with the hands and requires a minimum of simple equipment. The most valuable tip we could give to anyone who starts making plasticene models would be "keep cool"—both you and the model. As plasticene is worked, the oil within warms up, and the model becomes progressively softer and stickier until it is difficult to form and no longer retains its shape well. Our advice—store it in the refrigerator for a while. Chilled plasticene is firm and can be carved easily. Unfortunately, a hot, humid day may cause models to become sticky again.

A shellac coating as a final step for plasticene has desirable features, but several disadvantages as well. It gives the model a sturdy protective shell, and a glossy finished appearance. However, this coating is actually very vulnerable because, although it dries and hardens, the plasticene inside never will. If the model is dropped or hit, the plasticene will dent as usual, but the shellac will smash and crack. Also, two shellacked models may stick together, even months after the shellac is applied. Dr. Marengo has suggested powdering the models. By doing this instead of shellacking, an effective temporary way to prevent sticking is found. Wax paper has proved to be best for separating models when packing them. The main disadvantage of plasticene from the viewpoint of spore study is the fact that it is opaque.³

Plastic has the important characteristics of being transparent and relatively indestructible. It is, however, a much more difficult medium to use than plasticene, because plastic models must be constructed instead of modeled. Sharp edges are more easily constructed than the round edges of a true spore.

³ Since this paper was written, experiments have been made with another medium, Pyrocon, available from the General Glaze Corporation, Baltimore 11, Maryland. This is opaque and can be handled like plasticene, hardened in the oven for about five minutes at 350° F., and then cut with a very thin, sharp knife for perfecting, if necessary.

The immediate problem that arose was in the realm of solid geometry. To avoid a wasteful trial and error cutting of parts from plastic sheeting (acetate) and commercially made hollow spheres, certain facts needed to be known—particularly about the trilete spore shape. An electronics engineer helped us as a mathematical consultant and determined the interior angles and various arcs of the four units of a trilete tetrad. The interior angles at the crest are, by the way, 109.5° (approximately)—a highly treasured bit of information to anyone making trilete models.

Unfilled plastic models resemble very immature spores and are useful for comparing with microscopic material. The plastic shells can also serve as molds for clay, plastocene, wax, or gelatine models, or can be used as parts of other models.

The ideal material would be a clear plastic which could be modeled by hand and then allowed to become permanent, or which could be formed in home-made molds. So far, we know of no such plastic.

VALUE OF STUDY WITH MODELS

Not only are models helpful in checking ideas and impressions, but also they may suggest new ideas, sometimes quite by chance. For instance, the possibility of the triradiate ridge shadow occurred to us when we noticed one of the models produce such an effect. There are many such microscopic illusions which can fool the eye, so don't always believe what you think you see. The models have been valuable in indicating some of these misleading effects.

In discussions of theories, models can be an important aid. It is much easier to be specific and to avoid confusion of ideas when a 3-dimensional model is handy to point to or compare with the spore in question.

Finally, models are wonderful for explaining to the

layman in an easily grasped manner the spore story. Such fundamental terms as tetrad, trilete, and monolete are immediately clear ideas, not abstract, perhaps confusing, word images.

MISTAIRE LABORATORIES, MILLBURN, N. J.

The Microscopy of Fern Spores¹

F. GORDON FOSTER

The study of ferns under magnification is not a new or recent application of the microscope. History informs us that an artist was commissioned in the seventeenth century to make drafts of numerous plants then regarded by botanists as seedless, but now known to be teeming with minute spores. The microscopy of fern spores may be divided into three distinct sections—preparation, examination, and recording.

PREPARATION

The ultimate results of a microscopical examination depend to a large extent on the preparation of material. It is therefore most important that this phase of the work is not passed over lightly. It should be emphasized that no matter how carefully the subsequent steps of examination and recording are made, the original faults in preparation cannot be overcome. Since many microscopical examinations are made by means of slide preparations, it is necessary to master this part of the work. The material should be selected carefully before making the slide and its history well established. An otherwise excellent slide may lose much of its value if the identity of its contents is inaccurately recorded, or if the material was not well selected and cleaned. A sample of spores

¹ A talk given at the symposium on fern spores at Mistaire Laboratories, Millburn, New Jersey, June 4, 1955.

may be cleaned by pouring on a hard smooth white paper and gently tapping, which will cause a separation of the spores and their sporangia from other debris.

In the making of permanent microscopical slides, spores are mounted between a standard 25mm × 75mm glass slide and cover glass. A simple method is to place a very small number of spores on the slide and with a drop of mounting medium on a cover glass mull gently until dispersion is complete. After being clipped with a spring not in excess of ten grams, the slide is rested in a sloping position overnight. To accelerate the setting of the medium, a gentle heat of not more than 40°C can be used.

Slides may also be prepared by first dispersing the spores on a cover glass with a fixative such as 1/2% paralodion-acetate solution and subsequently mounting on the slide with the selected mounting medium. This method has the advantage of causing all of the spores to be in one plane which is helpful in the photomicrography of spore groups. This method, has, however, the disadvantage of "clumping," if the work is not carefully done.

Mounting media have multiple purposes. The medium is used for locating and holding the spores in position, providing an air tight and somewhat permanent housing for the spores, and supplying a connection between cover glass and slide that gives a more or less homogeneous medium for the light rays to traverse. For years, natural gums such as balsam and dammar have been used. While these have been relatively successful, they are slow in setting or hardening, and yellow on aging. More recently many synthetic resins have come into the market, and no doubt many more will be available. Care, however, must be used in the selection. Although most of these newer media are faster setting, there is a danger of using a medium which sets too fast and produces air

pockets in and around the specimens and edges of the cover glass. Permunt, a medium with a refractive index of approximately 1.56, while slower setting, may be used with little fear of bubbles and does not craze or yellow appreciably on aging. In selecting a mounting medium, it should be remembered that a medium with a refractive index similar to that of the spores will cause these to appear more transparent. A medium giving a greater refractive index differential will lessen this effect and cause the spores to appear in greater contrast.

Although long lasting, a slide preparation made with lactophenol cannot be considered permanent. This mounting medium, which may be plain or staining, has the advantage of clearing the denser portions, and is in itself an excellent preservative.

From the practical side, it is better to use the central area of a 50mm $\times$ 75mm slide, so as to preclude any of the mounting solution finding its way to the microscope. Scotch tape may be used to hold the cover in place for a short time. If an oil immersion lens examination is anticipated, a thin slide and No. 1 cover glass should definitely be employed.

No slide should be considered finished until it is carefully labelled. Identification may either be on a gummed label or directly on the glass with ink. If the paper label is used, it should be placed on the top side of the slide only. The information on the label should contain the following data as a minimum: Species, location and date collected, collector's name, mounting medium and dispersing agent if used, cover glass thickness, date of slide, maker's name.

EXAMINATION

The examination of fern spores really should start with the study of the frond with the unaided eye. By means of this cursory examination, much general knowl-

edge can be gained of the little world which surrounds this interesting organism, the spore. In addition to seeing the structure of the frond, it is also desirable to observe other features, such as the character of the pinnae, venation, and type and distribution of the sori. When such examination has been completed, further basic study can be made by using a magnifying glass. A high grade magnifier of the Coddington or Hastings type of ten diameters is preferable. Excessive magnification should be avoided because of the limitation of field and reduction in working distance.

For the ultimate in knowledge through visual study, a compound microscope is required. As in other instruments, great variations exist in microscopes—both in quality and in function. In general, the most useful type of microscope is the biological or medical type, an instrument designed for the examination of material of thin and somewhat transparent nature. Although spores are relatively small, they should be considered as three-dimensional organisms. It is this characteristic of depth that sometimes causes difficulty in the use of the compound microscope, and especially in recording either in a drawing or photograph. By means of shading in a drawing or by shadow casting in photography, the illusion of depth may be enhanced. Molded models as prepared and exhibited by the Mistaire Laboratory staff overcome this limitation.

Perhaps the greatest fault of the untrained user of the microscope is the incorrect method of illumination. The best microscope that may be purchased is of no more value to the user than some elementary instrument if he does not choose to adjust it carefully. There is no doubt in the experienced microscopist's mind that the Abbe-Nelson and the Kohler types of illumination are best. Briefly stated, the first of these systems focuses the illuminating source in the plane of the object by means of the

substage condenser. In the second system, the lamp filament image is projected on the substage condenser iris, and the condenser in turn focuses an image of the lamp iris in the object field. Both of these methods are excellent for visual work, the latter being especially beneficial for photomicrography.

Resolution, or the ability to observe fine detail as such, is a function of the wavelength of light and the numerical aperture of the objective lens. With a given light source, any use of the microscope which allows excessive closing of the substage iris decreases the effective numerical aperture and the resolving power, and can ultimately lead to spurious images and false interpretations. Control of the illumination intensity for eye comfort should be made by means of a variable transformer or neutral density filter. Since maximum resolution requires that the condenser back lens be completely filled with light, only the plane mirror should be used.

To get the most from a microscope regardless of age or make, the following simple instructions should be observed:

1. Place the instrument on a table with ample space.
2. Sit on a chair or stool which will allow comfort in using the microscope.
3. Carefully adjust the illumination to Kohler or Abbe-Nelson.
4. If not a binocular instrument, learn to keep the unused eye open, and alternate eyes from time to time.
5. Learn to check for dirt in the optical system: a. If on revolving the eyepiece the specks of dirt turn, clean the eyepiece; b. If the dirt moves when using the mechanical stage, clean the cover glass; c. Examine the condenser and mirror for dust; d. Make certain that no oil has been left on the oil immersion lens and all surfaces are clean.
6. Use proper components: That is, combine the eye-

piece with the objective for which it has been designed. Pairing an eyepiece of one manufacture with an objective of another may lead to less critical resolution. An eyepiece good for visual work is not necessarily the best for photographic work. The photographic amplifier, which is a negative component forming a diverging image, cannot be used visually.

7. Determine the value of transmitted darkfield illumination and surface illumination in your work. These are two very old methods, but they are not employed as often as they should be and are unknown to some.

8. Obtain oblique illumination by decentralizing the condenser iris or slightly tilting the mirror to aid in giving an impression of a third dimension.

9. Always watch the objective when focusing downward, in order to avoid damaging a slide or objective.

RECORDING

The importance of recording the observations of a microscopical examination must not be overlooked. It is in the observation and accurate recording that knowledge is preserved. The recording may be by the written word or by graphic means. In this brief discussion, the latter alone will be mentioned.

Basically there are two methods of recording the structures of the spore—by drawing and by photography. In drawing, the observer may examine the organism through the microscope and then draw from memory the result of the observation, returning to the instrument from time to time to refresh his memory. With this method, the accuracy depends on observation and artistic ability. Under ideal conditions excellent results may be obtained, particular advantage accruing from the incorporation of greater depth of focus and the omission of distracting debris contained in the slide. Other methods of drawing are by means of the camera lucida or micro-projector, methods familiar to all biological students. Here again,

however, the ultimate accuracy depends upon the observer.

Photographic recording has a high degree of accuracy, is convenient, and is reproducible. There is great variation in equipment used in photomicrography. Equipment may range from a simple eyepiece camera attached to a standard microscope allowing exposures to be made after each observation to special microscope-camera combinations using low power and high power lenses available for recording structures from natural size to 2000 diameters. With simple equipment, roll-film, which can be finished commercially, can be used. With more elaborate equipment, better results may be expected, but greater experience will be required for its proper operation.

Low power photomicrographs, generally called photomacrographs, are pictures having magnification up to about 10 diameters. In this range it is possible to record gross information, that is, the type of frond, the unrolling of croziers, the distribution of sori, and so forth. Work of this type is done with specially corrected lenses known as microtessars, microplanars, or microsummars, trade names of different manufacturers. Considerable overlapping exists in the magnification range of microtessar lenses; the final selection usually depends on available bellows draw and the desired area coverage.

Micrographs of fifty diameters and up are made by means of a compound microscope, the final magnification of the instrument being the product of the objective and the eyepiece at a projection of ten inches; by changing either of these optical components or extending the bellows the magnification may be increased. A high grade achromatic objective paired with Huygenian eyepieces used with proper filters will yield excellent results. The ultimate in photomicrography is obtained by using fully corrected apochromatic objectives and compensating eye-

pieces or amplifiers. It is always necessary to have the optical system correctly aligned and the specimen illuminated by the Kohler or Abbe-Nelson system. In photomicrography, a comprehensive trial and error method of exposure determination is still the best. By making a series of exposures on one negative, each exposure subsequently receives similar developing, and the ideal exposure may be selected.

Many different types of films are available for black and white photography as well as for color transparencies. In black and white work, orthochromatic and panchromatic films in different contrast ranges may be selected. Since the contrast is very low in many spores, it is necessary to select a film with a high contrast emulsion such as the contrast process orthochromatic or contrast process panchromatic. By slightly over-exposing, fully developing, and slightly reducing the negative in a bath of ferricyanide, a good image with a strong white background will be obtained. Inasmuch as spores are in general more or less monochromatic, little may be gained by the use of filters. It is best to select one type of film and learn its full capabilities, rather than becoming confused with many. In adjusting the microscope, excessive closing of the substage iris should be avoided since a diffraction image will result and depth of focus increased to the extent it will be hard to differentiate the various planes. The method of decentering the substage iris to give a relief effect, as already described for visual work, may be used to advantage in photomicrography.

In closing, it should be emphasized that a knowledge of the proper use of the microscope and photography are most useful adjuncts in the study of fern spores. Time taken to acquire mastery should be regarded as well invested. As in the time of Hooke and Van Leeuwenhoek, the microscope and its application is still a challenge.

NORTH TERRACE, MAPLEWOOD, NEW JERSEY

The Pteridophytes of Jackson County, Illinois

ROBERT H. MOHLENBROCK

(Continued from page 150, Oct.-Dec. 1955)

ASPLENIUM RESILIENS Kunze. This, one of the rarest spleenworts of Jackson County, is extremely difficult to find; it grows on limestone bluffs in the Grassy Knob area. It is more common in the Pine Hills of Union County. The uniform sterile and fertile fronds readily distinguish it from *A. platyneuron*.

SPECIMEN EXAMINED: Grassy Knob, Dec. 26, 1954, *M* 4948.

ASPLENIUM TRICHOMANES L. The Maidenhair Spleenwort, one of the most delicate of our ferns, is not common, although more abundant than *A. pinnatifidum*; it grows on moist shaded sandstone, in crevices of rocks. Elsewhere in southern Illinois, it is recorded from Union, Johnson, Pope, Alexander, and Hardin Counties.

SPECIMENS EXAMINED: Fountain Bluff, Sept. 16, 1921, *Steagall* 215; Midland Hills, March 11, 1941, *McCree* 613; Little Grand Canyon, June 26, 1951, *V* 692; Horseshoe Bluff, March 13, 1954, *V* & *M* 4788.

ATHYRIUM FILIX-FEMINA (L.) Roth var. *MICHAUXII* (Spreng.) Farw. The Lady Fern grows in very moist woods, like the two following species. It has been recorded in southern Illinois from Union, Johnson, Alexander, Pulaski, Pope, and Jackson Counties.

SPECIMENS EXAMINED: Leo Rock, Sept. 14, 1921, *Steagall* 176; Little Grand Canyon, Aug. 24, 1949, *BS* 819; May 13, 1954, *M* 4031 [representing f. *rubellum* (Gilbert) Farw.]; Giant City State Park, June 16, 1953, *M* 474.

ATHYRIUM PYCNOCARPON (Spreng.) Tidestr. The Narrow-leaved Spleenwort, our only *Athyrium* with simply pinnate leaves, is found in very mesic woodlands, where it is associated with *A. filix-femina* var. *michauxii* and *Aralia racemosa*.

SPECIMENS EXAMINED: Fountain Bluff, Sept. 14, 1940, *McCree* 433; Little Grand Canyon (most abundant where the stair-step creek at right angles to the north-facing slope flows into the valley), Aug. 24, 1949, *BS* 818.

ATHYRIUM THELYPTERIOIDES (Michx.) Desv. The Silvery Spleenwort, found in moist woods and along wet sandstone bluffs, is apparently less common than the preceding. Additional records from southern Illinois are from Union, Gallatin, and Hardin Counties.

SPECIMEN EXAMINED: Giant City State Park, June 16, 1953, *M* 476.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link. The Walking Fern, so named from its ability to take root at the tips of the slender fronds, is an indicator of slightly basic conditions, although it is often found on sandstone rocks. It prefers very moist areas in the deepest shade. At Giant City, it grows in company with the Puttyroot Orchid (*Aplectrum hyemale*), Celandine Poppy (*Stylophorum diphyllum*), and *Valeriana pauciflora*.

SPECIMENS EXAMINED: Fountain Bluff, Sept. 14, 1940, *McCree* 463; Midland Hills, April 28, 1952, *V* 1056; Giant City State Park, Jan. 11, 1953, *M* 55; six miles west of Murphysboro, "The Kin-koids," March 13, 1954, *V* & *M* 1804; Horseshoe Bluff, March 13, 1954, *V* & *M* 4793.

CHEILANTHES FEEI Moore. The Slender Lip-fern is a very woolly plant found only on calcareous bluffs in the southeastern section of the county. The fronds are much smaller than those of the following species. Like *C. lanosa*, however, the fronds curl during dry periods, and revive quickly after a rain. At the Devil's Bake Oven, this species grows with *Pellaea atropurpurea*.

SPECIMEN EXAMINED: Grand Tower, Aug. 24, 1948, *Bailey* 583.

CHEILANTHES LANOSA (Michx.) D. C. Eaton. This species, apparently more abundant in southern Illinois than in either Missouri or southern Indiana, grows on dry, ex-

posed sandstone bluffs along the Shawneetown Ridge, associated with the Prickly Pear (*Opuntia humifusa*), Goat's-rue (*Tephrosia virginica*), and American Aloe (*Agave virginica*). It is called *C. vestita* (Spreng.) Swartz in Fernald (1950).

SPECIMENS EXAMINED: Fountain Bluff, Oct. 7, 1949, *BS* 911; Giant City State Park, *M* 1910.

CYSTOPTERIS BULBIFERA (L.) Bernh. The Bulblet Bladder-fern, so-called because of its ability to produce bulb-like structures along its rachises, prefers calcareous soils, and hence is limited in its distribution in southern Illinois. I have seen it most abundantly along Rock Castle Creek, in Randolph County, where many plants are growing on a wet, liverwort-covered, east-facing sandstone bluff on which limestone has leached down from above. Across from it on the dry west-facing bluff is one of the two stations in southern Illinois for *Asplenium bradleyi*.

SPECIMENS EXAMINED: Leo Rock, Oct. 10, 1921, *Steagall* 21; Little Grand Canyon, Aug. 24, 1949, *Hatcher* 820; Giant City State Park, June 4, 1953, *M* 208.

CYSTOPTERIS FRAGILIS (L.) Bernh. var. *PROTRUSA* Weatherby. The Fragile Fern is undoubtedly the most common fern in southern Illinois, for it may be found on almost any moist bluff or in any mesic woods, growing with typical plants of moist woodlands, such as species of *Viola*, *Hydrophyllum*, and so forth. It resembles two other ferns of this area—*C. bulbifera* and *Woodsia obtusa*—differing from the former in not producing bulblets along the rachis and in having its veins running to the teeth rather than to the sinuses, and from the latter in the absence of scales along the rachis.

SPECIMENS EXAMINED: Southern Illinois University Farm, May 23, 1947, *BS* 66; Fountain Bluff, Oct. 10, 1921, *Steagall* 74; Carbon Lake, July 29, 1949, *Hatcher* 231: 7; four miles north of Carbondale, June 17, 1940, *McCree* 3602.

DRYOPTERIS AUSTRIACA (Jacq.) Woynar var. *INTERMEDIA* (Muhl.) Morton. This plant is rare in southern Illinois, where it is known from Pope, Union, and Jackson Counties, in the last only from the Giant City area, where it grows on moist sandstone bluffs. It is often called *D. intermedia* (Muhl.) A. Gray. The closely allied var. *spinulosa* (Müll.) Fiori [otherwise known as *D. spinulosa* (Müll.) Watt] is known in Illinois mostly from the north, but has been found twice in the south—along a gravel road in Union County (*Hatcher et al.*) and on moist sandstone at Ferne Clyffe State Park, in Johnson County (*V & M* 1906). It differs from var. *intermedia* by its eglandular, less-divided blades.

SPECIMEN EXAMINED: Makanda, Aug. 19, 1880, *Seymour* (UI).

DRYOPTERIS HEXAGONOPTERA (Michx.) C. Chr. This handsome fern, the Broad Beech-fern, is usually confined to moist woodlands, but I have seen it in very dry situations at Giant City, where it is not very vigorous however. It grows in abundance at Lake Murphysboro and Little Grand Canyon, in addition to the localities listed below. It is known also as *Thelypteris hexagonoptera* (Michx.) Weatherby.

SPECIMENS EXAMINED: Fountain Bluff, Aug. 22, 1952, *BS* 2839; Giant City State Park, Aug. 30, 1954, *M* 4687.

DRYOPTERIS MARGINALIS (L.) A. Gray. The Marginal Fern, one of our most attractive evergreen ferns, is one of the most variable. The typical form is by far the most abundant, but large forms, known as f. *elegans* (J. Robins.) F. W. Gray, in which the basal pinnules are pinnatifid, may be found (as at Little Grand Canyon, *M* 1905). At Saltpeter Cave, this species grows with *Mitchella repens* and *Luzula bulbosa*.

SPECIMENS EXAMINED: Fountain Bluff, June 18, 1940, *McCree* 155; Giant City State Park, June 24, 1947, *BS* 91; Little Grand Canyon, May 30, 1949, *Hatcher* 789; Saltpeter Cave, March 13, 1954 *V & M* 1801; Horseshoe Bluff, March 13, 1954, *V & M* 1807.

DRYOPTERIS NOVEBORACENSIS (L.) A. Gray. [*Thelypteris noveboracensis* (L.) Nieuwl.]. The New York Fern, one of Illinois' rarest ferns, has not been found in southern Illinois since 1880.

SPECIMEN EXAMINED: Makanda [Giant City?], Aug. 19, 1880, *Seymour* (UI).

DRYOPTERIS THELYPTERIS (L.) A. Gray. [*Thelypteris palustris* Schott]. The Marsh Fern is known from a single station in Jackson County, where its existence is being threatened, since the marsh in which it grows is being drained. We are in danger of losing not only this species from the flora of southern Illinois, but also several others which are present in the marsh, such as *Viburnum recognitum*, *Carex lanuginosa*, *Carex comosa*, *Apios americana*, f. *pilosa*, *Solidago patula*, and *Chelone glabra* var. *linifolia*. *Carex swanii*, growing adjacent to the marsh, is also in jeopardy.

SPECIMEN EXAMINED: "The Marsh," one mile north of Murphysboro, April 4, 1950, *Hatcher* 1157.

ONOCLEA SENSIBILIS L. The Sensitive Fern, common in rich woodlands in southern Illinois, is particularly abundant at Lake Murphysboro, where it is associated with Ginseng (*Panax quinquefolia*) and Virginia Snakeroot (*Aristolochia serpentaria*). At one station on Lake Murphysboro, it is growing in shallow water along the bank.

SPECIMENS EXAMINED: Giant City State Park, May 12, 1952, *V* 1220; Fountain Bluff, Sept. 14, 1921, *Steagall* 92.

PELLAEA ATROPURPUREA (L.) Link. The Purple Cliff-brake is limited in distribution in southern Illinois because of its preference for calcareous rocks. At Grassy Knob, it is found often with *Solidago drummondii* and *Phlox bifida*. The Smooth Cliff-brake, *P. glabella* Mett. (*P. atropurpurea* var. *bushii* Mack.), which differs in the nearly glabrous stipes and rachises, has been found in

southern Illinois only in Pope County; it should be looked for in the Grassy Knob area.

SPECIMENS EXAMINED: Fountain Bluff, Oct. 7, 1949, *BS* 912; Devil's Bake Oven, May 30, 1954, *M* 2428; Grassy Knob, Sept. 5, 1954, *M* 4781.

POLYPODIUM POLYPODIOIDES (L.) Watt var. *MICHAUXIANUM* Weatherby. The densely scaly fronds curl up during drought, like our species of *Cheilanthes*, and revive after a rain; hence the common name Resurrection Fern.

SPECIMENS EXAMINED: Leo Rock, Sept. 7, 1921, *Steagall* 284; Fountain Bluff, June 18, 1940, *Welch & Fuller* 165; Giant City State Park, Feb. 23, 1953, *M* 47.

POLYPODIUM VIRGINIANUM L. [*P. vulgare* var. *virginianum* (L.) Eaton]. The Polypody, much more common than the preceding species, usually grows on sandstone rocks or bluffs. Like many of the ferns of southern Illinois it is evergreen.

SPECIMENS EXAMINED: Fountain Bluff, Sept. 16, 1921, *Steagall* 276; Little Grand Canyon, Feb. 11, 1950, *Hatcher*; Giant City State Park, Jan. 31, 1953, *M* 493.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott. The Christmas Fern, one of the commonest and most admired ferns of the area, grows on slopes in shaded woods and on stream banks. The fronds are evergreen, and have been collected for decorations at Christmas time. At one place near Lake Murphysboro hundreds of plants cover a densely shaded east-facing slope.

SPECIMENS EXAMINED: Grand Tower, Oct. 29, 1922, *Steagall* 148; Fountain Bluff, June 18, 1940, *McCree* 206; four miles north of Carbondale, June 6, 1940, *McCree* 3603; Giant City State Park, Jan. 31, 1953, *M* 492; Lake Murphysboro, Feb. 26, 1954, *M* 4890.

PTERIDIUM AQUILINUM (L.) Kuhn var. *LATIUSCULUM* (Desv.) Underw. [*P. latiusculum* (Desv.) Hieron.]. The Bracken, by no means common in Jackson County, seems to be most abundant in southern Illinois in dry woods.

SPECIMENS EXAMINED: Hickory Ridge, Aug. 24, 1949, *BS* 815; three miles north of Carbondale, July 8, 1951, *V* 986.

WOODSIA OBTUSA (Spreng.) Torrey. The Blunt-lobed *Woodsia* may be distinguished from other ferns with which it might be confused by its scaly rachises and stipes. It is usually confined to moist shady bluffs, generally of sandstone. It may be found the year round, since it produces a winter rosette of sterile leaves, which are replaced in the spring by fertile ones. At Giant City it is associated with the Bishop's-cap (*Mitella diphylla*) and the Small-flowered Watercress (*Cardamine parviflora* var. *arenicola*).

SPECIMENS EXAMINED: Fountain Bluff, June 10, 1921, *Steagall*; Grand Tower, Oct. 29, 1921, *Steagall* 61; Giant City State Park, March 13, 1953, *M* 27.

In addition to the species of Polypodiaceae enumerated above, one other occurs in southern Illinois, although it has not been found in Jackson County as yet. This is the Hay-scented Fern, *Dennstaedtia punctilobula* (Michx.) Moore, which is known from Wabash and Pope Counties. It is distinguished by its glandular, fragrant leaves.

SALVINIACEAE

AZOLLA MEXICANA Presl. This tiny, mosslike fern is found floating in quiet waters. It is not uncommon in the Larue Swamp, Union County, growing with species of *Lemna*, *Wolffia*, and *Spirodela*. Fernald (1950) considers our species to be *A. caroliniana* Willd., which is restricted to easternmost North America by Svenson (1944).

SPECIMEN EXAMINED: Campbell's Lake, Oct. 11, 1940, *McCree* 563.

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The Status of *Pityrogramma calomelanos* in Florida

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The Tropical American, *Pityrogramma calomelanos* has been considered to be escaped from cultivation rather than native in Florida. Dr. J. K. Small¹ states that the first collection in Florida was that of W. A. Knight in 1931, who found it west of Fort Meade (Polk County); he quotes Mr. Knight: "... we found quite a large and thriving colony. . . . This is doubtless an escape

¹ Ferns of the Southeastern States 94. 1938.

but as it covers the bank of a road ditch for several rods it seems to be both thriving and reproducing itself so that you may, eventually, have another naturalized species to add to your list." Dr. Small visited the locality and collected specimens himself in 1934. Also, Dr. E. D. Merrill has mentioned this matter in his article "Fern Names Proposed by Rafinesque."² Rafinesque described a new genus and species of ferns under the name *Nesoris discolor*, based on material from Florida collected by Kim or Baldwin; Rafinesque's name *Nesoris* is five years later than Link's genus *Pityrogramma*. Dr. Merrill identifies *Nesoris discolor* as *Pityrogramma calomelanos* and adds, "This species was originally introduced into Florida more than a century ago, as an ornamental plant," a statement for which no documentation is given.

I do not understand why these authors should consider this species as an escape from cultivation. The material seen by Rafinesque must have been collected prior to 1838, at which time Florida had been a part of the United States only 18 years. Jacksonville, which had discarded its old name of Cow Ford some 16 years previously, St. Augustine, perhaps New Smyrna and a few other settlements were the only ones on the upper East Coast. In the west there were a few small towns on the West Florida strip to Pensacola, which was the only town on the upper Gulf Coast, with the possible exception of Appalachicola and the old town of St. Joseph. Fort Brooke, the site of which is now included in the city of Tampa, had been built in 1823, Fort Meade in 1835, Fort Myers in 1839, and Fort Christmas in 1846. All these were built during the Seminole Wars; it is safe to say that the inhabitants were busier fighting Indians than they were in importing and raising ferns. There were a few settlements below Jacksonville, along the upper St. Johns River, where were planted the first

² Amer. Fern Journ. 33: 50, 51. 1943.

orange groves in the state. The rest of the interior was a wilderness.

After the close of the Seminole Wars people began coming into Florida, and new towns and settlements sprang up. The early comers were chiefly interested in orange culture. Later, settlers came and built winter homes to escape the northern cold. For ornamental plants to beautify their homes, these early settlers depended chiefly on flowering shrubs that could be set out at the beginning of the rainy season and left to shift for themselves. Water was a serious consideration, for during a long, dry spring—I have seen years when not a drop of rain fell from January to June—water had to be drawn from deep wells by hand-operated buckets. Some of these ornamentals were of West Indian origin—Royal Poinciana, *Caesalpinia pulcherrima*, *Russelia juncea*, to mention just a few; these possibly came from seed sent or brought from the West Indies. There is now a beautiful Ceiba tree near Tarpon Springs, grown from seed sent by a missionary in Brazil about 75 years ago.

It was not until the 1880's that two circumstances started the purposeful introduction of tropical plants. The first was the establishment of the Royal Palm Nursery by the very young Reasoner Brothers. So far as I am aware, this was the first nursery in the state that was largely devoted to ornamental plants. Pliny, the elder brother, died of yellow fever in 1887; his 18-year old brother, Egbert, sent for his father and the rest of his family, and the nursery was carried on. Before Pliny died, the brothers had started going to Cuba by boat to bring in tropical plants, and Egbert continued the trips, going farther and farther into the tropics.

The second impetus to plant introduction was the erection of the Tampa Bay Hotel, which was completed in 1886 or 1888, where many introductions were made to ornament the grounds. At that time there were no quar-

antine restrictions on bringing plants into the country; all one had to do was to get them. People who had access to the West Indies brought in plants to ornament their home grounds or to add tropical fruits to their menus. Other than edible fruiting plants, the new introductions were mostly flowering ornamentals or palms, especially palms. There are today in the older parts of Tampa many rare and beautiful specimens which were brought in during this era.

My young days were spent in Tampa. I have a vivid recollection of the plants in the grounds of the Tampa Bay Hotel, but I do not remember a single fern. I have an incomplete file of old Reasoner catalogs. In the oldest one, dated about 1907, there is a list of ferns, small compared with other ornamentals, that includes *Gymnogramme tartarea* [*Pityrogramma tartarea*]; in catalogs of the 1920's this name was changed to *Ceratopteris tartarea* (a mistake for *Ceropteris*, which Mr. Reasoner assured me was a printer's error, but it was not changed in the last catalog, 1930). The description agrees with *Pityrogramma tartarea*, which is superficially similar to *P. calomelanos*. There is hardly any doubt that these two species have been confused, both being white-ceraceous beneath and both with the common name Silver Fern.

Several years ago, returning home from a trip to Tampa, I stopped at Chinsegut Hill. The Superintendent, Mr. Chapman, took me down a hillside and showed me a fern garden that he had made around a small spring. He had collected the ferns all growing naturally in the Brooksville area. I told him that I had all the species in my own fern garden except *Pityrogramma calomelanos*. He said that he had plenty and would like to give me one, but that as this was government property he was not allowed to dispose of anything. He added, however, that there were plenty of the ferns growing around a small pond on some land he owned a few miles farther

along my road toward home. I started on, parked the car where he said, and walked along a narrow lane between cultivated fields until I found the fence that enclosed Mr. Chapman's property. I climbed the fence and could see where the pond had been; the soil was hard and caked around the edges although still soupy in the middle. I did not find a fern of any species, and so I started back to the fence. Lying alongside where I had climbed over was a snake. I detoured to get over the fence in another place and saw another snake. Just then a man came toward me from the direction of a barn in the distance. He asked if he could help me, a polite way of asking what business I had there, so I told him he could get rid of the snakes. After he had taken a stick to them, I told him why I was there. He said that there had been plenty of ferns, but that they had died back when the pond dried up and would come out again when the rainy season started.

Pityrogrammas are very susceptible to cold, being killed back by light frost and entirely killed by severe cold, although a colony might be revived by spores lying dormant on the ground. It would seem now that they also disappear during dry seasons. These facts may account for their not having been collected in Florida between the time of Rafinesque and Mr. Knight's collection, a period of almost a hundred years.

Pityrogramma calomelanos is a tropical species. Maxon³ gives an imposing list of 24 islands in the West Indies on which it grows naturally, including Cuba and Porto Rico; the fern also grows on the continent, from Mexico to Brazil, and is introduced in parts of the Old World. All its associates in the Fort Meade area are West Indian species—*Thelypteris panamensis*, *Hypolepis repens*, *Meniscium reticulatum*, *M. serratum*, *Acrostichum aureum*, *Vittaria lineata*, and many others.

³ Pteridophyta of Porto Rico and the Virgin Islands 438. 1926.

During the past 25 years, I have grown several hundred species of ferns in my green house, and none has ever escaped outside the greenhouse, although often young sporophytes do appear beneath the benches and in pots with other plants. Of the 85 to 100 species usually growing outdoors in the fern garden, only one, *Lygodium japonicum*, has possibly escaped; I found three or four small plants of this species growing in the edge of a swamp about a mile from my place, in 1934 or '35. This is not a commonly grown fern; at the time, I did not know of another plant anywhere in the city—and I usually do know most of the plants that are grown here.

Lygodium japonicum is a climbing species, and long-distance dispersal of the spores of climbing or epiphytic ferns seems much more likely to occur than of low-growing, terrestrial species. The ground air-currents are weaker, and when a strong wind does strike low ferns it comes from above and the fronds are flattened down and the spores shaken out beneath; on the contrary, the normal air-currents blowing on climbing and epiphytic ferns will be stronger, and will strike the sporophylls from beneath, and so the spores will be carried much farther. Also, the spores are much less likely to be caught on grasses and other lower-growing vegetation than in the case of ground ferns.

The long-distance distribution of spores is facilitated by storms, and it is more than probable that hurricanes are responsible for the introduction of our West Indian species. This is borne out by the widely disjunct distribution of a good number of our species. A particularly striking case is that of *Asplenium auritum*, which has been known in a few localities in the Brooksville area, in Hernando County, on the middle West Coast; this species has recently appeared in Sykes Hammock, near Homestead (in Dade County), in the southernmost part

of the state. My herbarium specimens from two of the Brooksville localities and from Sykes Hammock differ in the cutting of the pinnae, indicating that the colonies may have originated at different points in the West Indies. *Polybotrya tenuifolia* was introduced into Tampa 20 years ago or more. It has been reported as growing wild in Hillsborough County, where it may well be and probably is, an escape from plants cultivated in Tampa; the species is high-climbing, and has spores freely produced on sporophylls borne high on the plant. There are several other species of ferns growing "wild" within the state that are considered as escapes from cultivation; I think that research should be done to determine, if possible, their correct status.

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The Virginia Chain-fern

C. V. MORTON AND CHARLES NEIDORF

The Virginia Chain-fern, *Woodwardia virginica* (L.) J. E. Smith, is a rather well-known inhabitant of acid bogs on the coastal plain of the eastern United States. The accompanying illustration is taken from a plant in the garden of Miss Clara S. Hires, of Millburn, New Jersey. It shows a character that apparently was mentioned for the first time by the senior author,¹ namely the glandularity of the indusia. The glands, which are found both on the backs and margins of the indusia, are composed of a single-celled, colorless stalk, and a brownish, several-celled, subspherical head. Herbarium studies indicate that such glands occur on all specimens, in greater or lesser numbers, but this is a point that should be verified by studies in the field. Similar glands occur elsewhere on the fronds of *W. virginica*, but apparently not in other species of *Woodwardia*.

¹ In H. A. Gleason, *The New Britton and Brown Illustrated Flora* 3: 37. 1952.



WOODWARDIA VIRGINICA

The Virginia Chain-fern is the type and only species of the genus *Anchistea* Presl, which is recognized as valid by Broun (Index to North American Ferns), Small (Ferns of the Southeastern States), and other authors. Its claims to recognition are slight. Presl depended on the cartilaginous margins of the segments and the superficial sori, but neither character is distinctive; the margins are not essentially dissimilar to those of some other species, and, although *W. radicans*, the type species of *Woodwardia*, does have the sori deeply immersed in the leaf-tissue, other species that are obviously congeneric (e.g. *W. japonica*) have superficial sori as in *virginica*. The only character (except the glandularity mentioned above) distinguishing *virginica* from all other species is having the areoles in a single series along the costae, instead of in two series or more, hardly a generic distinction.

Shorter Note

AUXIN AND PSILOTUM.—The keystone in the development of the modern recognition of all vascular plants as one division (or phylum), for which the names Stelophyta and Tracheophyta have been proposed, was provided by the work of Kidston and Lang in the early nineteen-twenties. Studying a band in the Old Red Sandstone (Devonian) of Scotland, they described several plants of presumed pteridophyte affinity that were characterized by leafless, forking growth, both above and below ground. The rootless condition was interpreted as primitive, root and leaf differentiation not yet having taken place. About ten years later, Lang and Cookson described still earlier vascular plants of a similar type, from the Silurian of Australia. This group was recognized as a distinct group of vascular plants and given collectively the designation Psilopsida. These conclusions have received wide acceptance, and psilopsids are rather generally recognized as coordinate with, though pre-

sumably ancestral to, the lycopods, horsetails, and the fern and seed-plant congeries. Two modern representatives of Psilopsida are accepted—*Psilotum*, pantropical, and *Tmesipteris*, of the Australian area.

In Science for Sept. 30,¹ W. P. Jacobs reports what amounts to an interesting physiological confirmation that the rootless character of modern *Psilotum* has a phylogenetic basis. Using three synthetic auxins, well known as capable of stimulating the origin of roots on many higher plants, even on leaves and stem internodes, he tested *Psilotum* and a variety of other plants, including mosses and algae. The results were negative. At the same time, similar tests with horsetails and lycopods brought positive responses. The author leaves in abeyance the question of whether auxins may not cause increased development of rhizoids in *Psilotum*, as it has been found to do with mosses and algae. One positive result of Jacobs' tests was the finding of diffusible, natural auxin in *Psilotum* shoots.—R. C. BENEDICT.

Recent Fern Literature

A BOOKLET ON BRITISH FERNS.²—In general, British nature guide-books are freer from misunderstandings and errors than comparable American ones. However, a convenient-sized volume ($3\frac{3}{4} \times 5\frac{3}{4} \times \frac{3}{4}$ inch) which has just come to my attention is disappointing in this respect. The Introduction and Glossary contain quite a number of poorly worded statements and other technical errors. Each of the 45 species treated in detail is allotted 2 or 3 pages of interestingly written text, covering general aspect, habitat, ranges in Great Britain, and detailed characters. The plates, in green and red-brown, bear illustrations of one or two species each. They vary consider-

¹ 122: 597. 1955.

² The Observers Book of British Ferns, compiled by W. J. Stokoe. Pages 1–128, pl. 1–26. Frederick Warne & Co., Ltd., London & New York. 1950. (Price about \$1.50.)

ably in quality; a few are excellent, as *pl. 14, Ceterach*, many are fair, but some, like *pl. 22*, purportedly *Dryopteris filix-mas*, are erroneous. On *pl. 5*, the legends are reversed, and on *pl. 10* two species are illustrated but only one named. In too many places the text and illustrations disagree in one or more respects. Thus, the rachis of *Asplenium trichomanes* is described as "purplish glossy black," but in *pl. 8* is shown as pale brown. In *Cystopteris fragilis*, "the stalk is purplish black," and the frond widest "about the middle," yet in *pl. 17* shown as bright green and widest just above the base, respectively. When errors, misunderstandings, and contradictions appear in technical works, the specialist can soon catch and correct them; but when they are allowed to get by in books for the beginner only confusion is likely to result. It is regrettable that to the list of three inaccurate or inadequate popular American fern books a British one must now be added.—EDGAR T. WHERRY, *Philadelphia, Pa.*

A NEW ZEALAND FERN BOOK.—The ferns are among the most striking botanical features of New Zealand, where they reach an abundance and luxuriance equalled in few other temperate countries. There are about 150 species, ranging from minute filmy-ferns to tree-ferns and including several strange Southern Hemisphere genera. The study and enjoyment of these will be greatly helped by the new "Book of Ferns," just published by Dr. Greta Stevenson, a well-known New Zealand botanist.¹ This attractive book of 160 pages and 67 plates describes briefly over a hundred of the species and illustrates 72 with excellent habit drawings by the author. In addition, the book has a good summary of what the amateur fern stu-

¹ A Book of Ferns, by Greta Stevenson, pp. 1-160. 67 figs. 1954. Obtainable from Henry George Fiedler, 31 East 10th Street, New York, 3, N. Y., at a reasonable cost.

dent needs to know about names, reproduction, cultivation, and identification of ferns. No one interested in ferns who visits New Zealand or enjoys knowing exotic ferns can afford to be without this book.—F. R. FOSBERG.

“GROWING FERN PROTHALLIA,”¹ by Herbert M. Clarke, Professor of Botany, University of Wisconsin, gives detailed instructions for growing prothallia on a large scale for classroom use. A limited number of reprints are available to interested persons.—C. V. MORTON.

“FLORA OF DOMINICA, B. W. I.,”¹ by Walter H. Hodge, contains the most extensive treatment of West Indian ferns that has appeared in many years. Nomenclaturally, the treatment is conservative. Although not all the ferns of neighboring islands are included, a good many of those of Guadeloupe and Martinique are keyed, in the expectation that some will be found in Dominica eventually.—C. V. MORTON.

Another treatment of the pteridophytes of Illinois by Dr. G. N. Jones has appeared.¹ The account of the ferns is much less complete than Dr. Jones' previous “An Enumeration of Illinois Pteridophyta,” (1947), but it does have maps for each species illustrating the range in Illinois by counties. New records for the state are: *Lycopodium flabelliforme* (first found in 1952), and *Pteris multifida* (a casual occurrence, now extinct). Some of the ideas that conflict with current treatments, such as the complete reduction of *Pteridium aquilinum* var. *pseudocaudatum* to synonymy under *P. latiusculum*, deserve some discussion. Unusual in a local flora is the attempt to indicate the authorities and places of publi-

¹ Amer. Biol. Teacher 16: 214, 215. 1954.

¹ Part I. Lloydia 17: 1-238. 1954.

¹ Vascular Plants of Illinois, by G. N. Jones and G. D. Fuller. Illinois State Museum Sci. Ser. 6: 1-593. 1955.

cation for the names of families and higher categories. Unfortunately, the names selected are not quite in accord with the International Code of Botanical Nomenclature. Thus Tracheophyta is termed a "Phylum," a category not recognized in the Code; according to the Code the termination *-phyta* indicates a Division. Lycopsida, Sphenopsida, and Pteropsida are termed "Subphyla," but the endings indicate that these are Classes. Again with "Class Lycopodiineae," the termination *-ineae* is properly that of a Suborder. The determination of the proper authorities for Ordinal and Family names is a matter of great difficulty; thus the family Lycopodiaceae is attributed by Jones and Fuller to Warming (1879), but it was surely used long before that date, according to Dr. Clyde F. Reed first by L. C. Richard (in Lam. & DC., 1805). A paper on this subject by Dr. Reed will appear in a future number of the Journal.—C. V. MORTON.

Another state fern flora has appeared—"THE FERNS AND FERN ALLIES OF NEW MEXICO,"¹ which shows clearly the results to be achieved by intensive exploration. The "Flora of New Mexico," by Wootton and Standley (1915), contained 41 species of Pteridophyta; the present treatment lists 59 species, almost a 50 per cent increase. This is not an inconsiderable total for a state as generally arid as New Mexico. Some of the newly discovered species are conspicuous plants like *Cystopteris bulbifera*, *Pityrogramma triangularis*, *Cryptogramma acrostichoides*, *Gymnocarpium Dryopteris*, *Asplenium platyneuron*, and *Cheilanthes tomentosa*; most of these are probably quite rare and local in the state. The text of the book, which is clearly and beautifully printed, gives keys and descriptions; the illustrations are well drawn

¹ By H. J. Dittmer, E. F. Castetter, and O. M. Clark. Univ. New Mexico Publ. Biol., no. 6, pp. 1-139. 1954. Univ. of New Mexico Press, Albuquerque, N. Mex. \$1.00.

and should render the identification of specimens an easy matter.—C. V. MORTON.

Two papers by Dr. Warren Herbert Wagner, Jr., are to be noted. One¹ describes a natural hybrid between *Polystichum acrostichoides* and *P. Lonchitis* that was found growing with the parents on the Bruce Peninsula, Ontario. It was vigorous in vegetative growth, but apparently sterile. In morphology it is intermediate between the parent species. The other, more extensive paper² reports for the first time the chromosome numbers of several eastern American ferns. These numbers have important taxonomic implications, among them: That *Botrychium oneidense* has the characteristics of a normal species and not a hybrid; that *Onoclea* and *Matteuccia* are not closely allied, as has been assumed; that *Cystopteris tennesseensis* is very likely a hybrid, as has been assumed; that the numbers in *Thelypteris* are remarkably different (*T. noveboracensis* 27, *T. Phegopteris* 30, *T. palustris* 35,³ indicating that possibly the genus, even in a restricted sense, is polyphyletic; that the eastern American variety of *Asplenium Ruta-muraria* has the same number as the European; and that *A. Trudellii* has a number indicating it to be a hybrid rather than a variety of *A. pinnatifidum*. A number of reprints of the latter paper are available from the undersigned.—C. V. MORTON.

¹ A Natural Hybrid of *Polystichum Lonchitis* and *P. acrostichoides* from the Bruce Peninsula. (with Dale J. Hagenah.) *Rhodora* 56: 1–6. pl. 1198. 1954.

² Cytotaxonomic Observations on North American Ferns. *Rhodora* 57: 219–240. figs. 1–33. 1955.

³ Manton indicated 34 in European *T. oreopteris*.

American Fern Society

Report of the President for 1955

For three score and three years, presidents of the American Fern Society have been submitting annual reports.¹ The present report is merely the latest in the long chain that began in 1893. In preparation for this, my fourth and final report as President, I have scanned carefully all the reports of my predecessors. This review has proved so interesting that it has been hard to refrain from extending unduly my statement by citations from past records. However, I have limited historical references almost entirely to emphasis on what have proved to be the two major objectives of the Fern Society through all the years: the continued growth in membership, and the mission of the Society to serve all members, whether beginners or advanced research students.

From the earliest report of the first President, Willard N. Clute, to that of my immediate predecessor, Joseph Ewan, the presidents and other officers have urged, even exhorted, the members to work for greater and greater numbers. None has been more enthusiastic or optimistic than William Maxon. In his report for 1900, when the membership roll was a little more than 100, he saw no reason why it should not at that time be expanded to 500. The 500-mark was not finally attained until 1953, but, as a result of my experience during the past four years, I am ready now to equal Maxon's optimistic forecasts of 1900 and predict that a five-fold increase in Fern Society membership can be reached from today's figures and in

¹ Twenty-one different individuals have held the presidency since 1893, with terms of office ranging from the six months of Mrs. William Dershimer, advanced from the vice-presidency in 1896, to the seventeen years of William R. Maxon in his two tours of service: 1899-1900, and 1919-1933. Only 55 formal presidential reports have been published in the 63 years, but the omissions have been partly balanced by several "Remarks" offered by Presidents-elect.

not too long a time.²

There is no dearth of possible new members; in fact, the number of nature lovers who might be interested in joining is greater than ever before. During the past 16 years, 670 accessions have been recorded. For the first 11 of those years, from a total of 400 new members, a net gain of 30 was made, but the dislocations of the war years provide many reasons for the slow growth. Within the past four years, from accessions of 265, the membership roll rose from 430 to 564, a net gain of 134. Actually, this gain was achieved in the first three years, 1952-1954.

At the beginning of 1955, it was my hope that the growth rate of the preceding three years might be continued, and that a total of 600 might be achieved before 1956. Instead, for a variety of reasons, the total membership numbers have remained stationary; 48 new names were added to the list, but an equal number was removed. However, no year can be counted unsuccessful which has included such well-planned meetings as the June gathering in Milburn, N. J., under Miss Clara Hires' leadership, the late summer Canadian field-trip to the Ontario hart's-tongue localities, led by Prof. James Soper, and the Michigan meetings and field-trips in September, for which Professors Knobloch, Wagner, and Dansereau were chiefly responsible. Furthermore, one of the most promising developments of 1955 was the organization of a "New England Committee," under Dr. B. R. Allison, and its promotion of a delightful two-day series of meetings and field-trips in New Hampshire and Vermont during July. In 1956, further activity on the part of this Committee may be expected. Appreciation is also due to three Pennsylvania trip leaders, Messrs. W. L. Dix, Maurice Broun, and R. K. Lampton, and to Mr. J. E. Benedict, as

² The growth rate of the Fern Society by hundreds has been as follows: 100 in 1898, C. E. Waters, President; 200 in 1911, Philip Dowell, President; 300 in 1922, W. R. Maxon, President; 400 in 1943, Robert T. Clausen, President; 500 in 1953.

leader of a trip in Virginia.

Further healthy growth of the Fern Society must depend not only on ever-expanding accessions but even more on providing for new members the kinds of service that will make them want to remain in the Society. In fact, the addition of large numbers of new members only to have them drop out in a year or so is most wasteful of the energies of officers and other members and of the capital assets of the Society—its back files of Fern Journals. A heavy turn-over of members is nothing new in Society history. Even in 1893, when the total of listed names by the year's end was 29, only 23 actually qualified by paying their dues—advance payment not then being a requirement for enrollment. At the present time, an increased rate of growth can only be accomplished if both objectives of the Society are realized—the attraction of new members, and such services as will hold them.

The Treasurer, Dr. McGregor, reports that a good many of those who resign give as a reason that the Fern Journal is "too technical." That complaint has been made since the Journal was started in 1910. Suggestions have been made from time to time that in each issue of the Journal, a few pages should be reserved for beginners and filled with the most elementary fern lore. I do not believe the editorial policy of our periodical should be changed from what it has been for 45 years, but I do believe that the interests and needs of beginners should be met by appropriate printed matter. My suggestion is for a series of bulletins, some mimeographed, some reprinted from appropriate Journal articles, to be kept in stock and made available to new members. I am sure the least experienced of tyros could be carried forward in knowledge through such bulletins, to an appreciation of the Fern Journal as a unique botanical periodical, widely accepted for its scientific standing, and also for its coverage of popular fern-lore.

It may be noted that this proposal involves no departure from earlier policies and practices. During the first seven years of the Society, members received a wealth of extra dividends in the way of popular fern books and technical "Fernwort Papers" and other material. Since then, distribution of extra material has been sporadic but never entirely stopped. Through the mid-years of the Society, various members contributed extra copies of reprinted articles for such purposes: Maxon, Wherry, Christensen, the Thurstons, and others. During the affiliation with the Brooklyn Botanic Garden, Garden Leaflets on fern topics were widely used, together with hundreds of young hart's-tongue plants raised at the Garden. What is here proposed is the planned preparation of a series of bulletins of interest and help to those starting in fern study, and the distribution of these according to an organized plan. The proposal will be made clearer by a consideration of the following suggested list of bulletin titles.

1. Ferns as a hobby: various lines of study; the Fern Society.
2. Primer of fern structure and function.
3. Making a fern herbarium; services of the Society Herbarium.
4. Fern books for beginners and others; the Society Library. (See also earlier bulletin issued by the Society: "Fern books to lend.")
5. Checklists of ferns according to major areas, by states, etc.
6. Native ferns and their preferred haunts; fern ecology.
7. Soil-testing, in field and garden.
8. Fern gardens; appropriate native and introduced species and varieties.
9. Raising ferns from spores; the Society "Fern spore exchange."

10. List of information centers in the U. S. and Canada. (See 1952 list in the Journal.)

11. Ferns as house plants.

12. Field-trips and other meetings.

The preparation of such a series of bulletins would be a matter of gradual development, with titles assigned to appropriate members; some of the topics fairly cry for particular members, whose interest and qualifications along certain lines are well known. Such a program of bulletins would call for a first investment of money for the printing or mimeographing, but my experience of the past few years convinces me that the cost would be very quickly returned in the continued dues of members held in the Society. Some of the topics could be well covered by as little as a two-page statement; others might require two or three times as much space. As a test of the interest in the preceding proposals, I urge that members indicate their reactions by writing to President Wiggins or to other officers to state (a) whether they would like to receive such bulletins, and (b) their willingness to aid in the preparation of any of the needed manuscripts, or in their duplication.

Two other tried and tested measures are recommended for increased emphasis—expanded programs of field-trips and other meetings, and the promotion of area associations or “chapters,” with special standing committees. When the Society had just passed the 50 mark in membership, Willard Clute wrote that some areas had enough members to permit of “strong associations.” Ten years later, James Ferriss reported the formation of the first such group, with a name—the Woodsia Chapter of Muscatine, Iowa. It remained for Matt Mann to demonstrate within the past ten years how such a local association (in New Jersey) could be effectively carried on. The New England Committee of 1955 is a promising further demonstration.

A field-trip program and some local organization go hand-in-hand. It has long been a policy of the Society to hold one formal annual meeting in connection with one of the convocations of scientific societies, with a local committee in charge. Additional trips have occasionally been scheduled, often jointly with some other botanical organization. For greatest service to members, however, the more meetings the better, not only for their service to beginners but also for the friendships they promote among members. While areas with larger concentrations of members offer greater opportunities for such meetings, even members in isolation have the opportunity, which any hobbyist enjoys, of sharing his interest with his neighbors.

When in the fall of 1951, my acceptance of the nomination for President was being considered, a friend of long experience in the Society wrote that the work would not be "too onerous." Nothing as thoroughly enjoyed as the past four years can be called "too onerous," although the time and effort spent have been considerable. The work with the other officers and with many other members, involving the addition of many friends, has made the past four years stand out as the climax of my 50 years in the Society. I hope I may continue to help in Society affairs, and I hope also that many other members will offer their services to the new President, Dr. Ira L. Wiggins.

Respectfully submitted,

R. C. BENEDICT, *President*

Report of the Secretary for 1955

The total membership for the Society at the end of 1955 was 564. There were three new life members: Miss Harriet E. Baker (1941), Mr. Boughton Cobb (1946), and Mr. George R. Cooley (1956). Forty-eight new members were added and 47 withdrew. Seven of the new ones

were from foreign countries, as were five of the seven new subscribers. The Society now includes members from 41 states, the District of Columbia, and 19 foreign countries. Those with ten or more members are, in descending order: New York, California, New Jersey, Massachusetts, Pennsylvania, Connecticut, Ohio, Florida, Washington, D.C., Illinois-Michigan, Virginia-Canada, Missouri-Wisconsin, and Maryland.

We regret to report the deaths of the following members: Mrs. E. M. Foote (1925), Mr. Hugh M. A. McEachran (1948), Dr. Theodore S. Palmer (1911), Miss Nettie M. Sadler (1943), Mrs. G. W. Strattan (1916), and Dr. Campbell E. Waters (1893). Dr. Waters was an honorary as well as a charter member.

The Annual Meeting was held with the A.I.B.S. at Michigan State College, East Lansing, Michigan, on Monday and Tuesday, September 5 and 6. This was preceded by the Bruce Peninsula field-trip, August 31 to September 3, and started with an all day field-trip Monday, September 5, with the American Bryological Society to localities of the central part of southern Michigan. The morning of September 6th was devoted to contributed papers, with Pierre Dansereau presiding. The scheduled papers included: "The Distribution of Ferns in Kansas," by Ronald L. McGregor; "New Cytological Data on North American Ferns," by Warren H. Wagner, Jr.; "The Status of Our Knowledge of the So-called '*Hymenophyllum*' Gametophyte of the Appalachian Region," by A. J. Sharp and W. H. Wagner, Jr.; "The Morphology of the Gametophyte of *Mohria*," by Lenette Rogers Atkinson; "Taxonomic Characters of the Genus *Ceratopteris*," by Charles E. DeVol; "The Ferns of the Atlantic Islands," by Pierre Dansereau; "The Fern Genus *Woodsia*," by Donald F. M. Brown; "The Interrelationships of the Eastern North American Members of the *Dryopteris spinulosa* Complex," by

Edgar T. Wherry; "A Review of the Taxonomic Status of the Polypodiaceae versus the Grammitidaceae," by Kenneth A. Wilson; "Noteworthy Arkansas Pteridophytes," by Dwight M. Moore; and "Milestones in Fern Research," by Ralph C. Benedict. The formal meeting was followed by a luncheon in the Union Building, with informal discussions and reports of field-trips. The representatives, I. W. Knobloch and Warren H. Wagner, Jr., were responsible for an excellent demonstration set up in one of the laboratories for the entire week of the meetings; this consisted of an exhibition of variations of Mexican pteridophytes; variations of the grape-ferns (*Botrychium*); gametophytes of the genus *Mohria*; and various living ferns, including backcross hybrids of spleenworts (*Asplenium*). There were a number of pamphlets and keys on ferns displayed.

Respectfully submitted,

MILDRED E. FAUST, *Secretary*

Report of the Treasurer for 1955

The Fern Society ended 1955 in good financial condition. Income from dues of members and subscribers, sale of back numbers, etc., amounted to \$2,243.03—the highest on record for the Society. This was helped considerably by the 64 individuals who are sustaining members, and by the brisk sale of back volumes, and gifts. Publication costs did not increase, but such costs still account for over 90% of our expenses. No withdrawals were made from the reserve fund or the two special accounts.

During the year the number of members in arrears for payment of dues was reduced by 96%, and thus our financial condition was further improved. Members who do not pay current dues are being notified three times, and are then removed from the rolls if payment is not received.

Numerous changes of addresses were made in 1955. Many notifications were received just after the mailing of each number, which resulted in members failing to receive copies of the Journal or experiencing delay. Members should notify the Treasurer of changes of address by the middle of February, May, August or November, if they wish to receive the Journal promptly upon publication.

Your Treasurer sent out over 1800 items of correspondence during 1955. This is an indication of the activity of the Society and its healthy condition, due largely to the interest and response of its members.

	<i>Receipts</i>	<i>Amount</i>	<i>Total</i>
Cash on hand, Jan. 1, 1955			\$1,315.80
1954 membership arrears	\$ 20.00		
1955 membership renewals	726.00		
1955 sustaining members	319.65		
1955 new members	91.35		
1956 membership renewals	29.35		
1956 new members	17.35		
1954 subscription arrears	4.80		
1955 subscription renewals	113.72		
1956 subscription renewals	242.30		
Life memberships	85.00		
Sale of back numbers	248.72		
Sale of reprints	199.47		
Sale of surplus library books	54.15		
1955 advertising	40.00		
Gifts	51.17		
			2,243.03
			\$3,558.83

	<i>Disbursements</i>	<i>Amount</i>	<i>Total</i>
A. F. J. Vol. 44, No. 4	\$ 412.85		
A. F. J. Vol. 45, No. 1	512.61		
A. F. J. Vol. 45, No. 2	326.90		
A. F. J. Vol. 45, No. 3	360.49		
Envelopes—mailing	84.46		
Reprints	197.74		

Expenses

President	38.84
Secretary	18.44
Treasurer	76.85
Editor	20.00

 2,049.18

 Cash on hand, January 1, 1956 \$1,509.65

STATEMENT DECEMBER 31, 1955

<i>Assets</i>	<i>Amount</i>
Cash on hand	\$1,509.65
Bissell Herbarium Bequest	616.20
Life Membership Fund	707.48
Reserve Fund	1,686.68
Inventory A. F. J.	3,148.63
A. F. S. Library	446.00
	\$8,114.64
<i>Liabilities</i>	<i>Amount</i>
Capital Account	\$6,020.97
Suspense credit	
1956 memberships	46.70
1956 subscriptions	242.30
Distribution Vol. 45, No. 4, A. F. J.	484.99
Bissell Herbarium Fund	612.20
Life membership fund	707.48
	\$8,114.64

Respectfully submitted,
 RONALD L. MCGREGOR, *Treasurer*

Report of the Auditing Committee

We hereby certify that we have seen the books and accounts of Dr. Ronald L. McGregor, Treasurer of the American Fern Society, and have obtained confirmation of the correctness of the Society's balance on hand as set forth in detail in the accompanying report of the Treasurer.

EMILY L. HARTMAN
 W. H. HERR
Auditing Committee

Report of the Judge of Elections

The results of the balloting for officers of the American Fern Society are as follows:

For President

Ira L. Wiggins	243
Ralph C. Benedict	7
Walter S. Allen	1
C. V. Morton	1

For Vice-President

Dwight M. Moore	252
Mrs. William S. Learned	1
Harold G. Rugg	1

For Secretary

Mildred E. Faust	253
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For Treasurer

Ronald L. McGregor	252
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I therefore declare the following candidates elected to the several offices: President, Ira L. Wiggins; Vice-President, Dwight M. Moore; Secretary, Mildred E. Faust; Treasurer, Ronald L. McGregor.

Respectfully submitted,

ALICE A. BRISTOW, *Judge of Elections*

Report of the Curator and Librarian for 1955

There has been an encouraging increase in the use of the Library during the past year, and I think that even more use would be made of it if the contents were better known. Although there are two lists available to send to members requesting information about books in the Library, they are both old and rather brief. We are hoping that a complete list, which will be sent to every member, may be published in the near future. Prior to the preparation of this list, I would like to solicit reprints from all members who have published in the Journal, or elsewhere, so that these titles may be included. It is much easier to send on loan a few reprints than the bound volumes of the Journal in which the articles appear

and this also eliminates delay in the case of duplicating requests. Mr. Morton contributed three books to our book sale and Dr. Benedict sent the remainder of Mr. M. D. Mann's library, which he had received from Mrs. Mann for the Society. Several of the books were additions to our collection and the others were sold.

There has been no special activity in relation to the Herbarium.

Respectfully submitted,
ROLLA M. TRYON, *Curator and Librarian*

Report of the Spore Exchange

The Spore Exchange, the infant project of the Fern Society, has come to the end of its second year of existence, and a brief report of activities may be in order.

During 1955, eleven members sent spores to the exchange—some only one species, others several to many. In addition, three other persons, not members, knowing of its existence, contributed interesting species, and we have the promise of four others to send spores as soon as they are available. And so, contributors this year numbered 14 (last year, eight).

Thirteen people requested spores, and a total of 101 packets were sent to ten of these; the other three received lists of available species but have not yet replied with specific requests. The number of packets sent to one person varied from two to 19. Ferns requested, as well as contributed, are of two sorts—tropicals and others for greenhouse use, and hardy natives for outdoor planting; both are welcomed.

Requests that we have been unable to fill include the following: *Athyrium crenatum*, described as something like a coarse, all-green *A. Goeringianum* f. *pictum*; *Pteris aspericaulis* f. *tricolor*, described as "like *argyraea* but with red instead of white markings"; *Campyloneuron phyllitidis*; *Pellaea andromedifolia*; *Asplenium pinnatifidum*, *A. montanum*, *A. Bradleyi*, *A. Ruta-muraria*;

Cryptogramma Stelleri, and any *Adiantums* (for greenhouse use). If any reader can cause any of these to materialize, it will be greatly appreciated.

Though the number is small, our contributors and users write from England, Canada, California, New England and points between. The interest of the few is great, and the appreciation of the existence of the exchange seems very real. We urge more members to keep the exchange in mind. And as strongly, we urge more members to start in planting spores; it is easy and exciting, and the reward for little effort satisfying indeed.

A fertile frond or a piece thereof, an envelope, a stamp—it takes only a moment, but perhaps that is the very fern some other member may desire above all others. Address that envelope (and your requests for spores) to
Mrs. Kathryn E. Boydston,
Fernwood, Route 3, Niles, Michigan

SYMPOSIUM ON FERN SPORES, MISTAIRE LABORATORIES,
MILLBURN, NEW JERSEY, JUNE 4, 1955.

Forty-seven members and guests of the American Fern Society and the Torrey Botanical Club met for an interesting full-day program comprising a symposium centered around fern spores and a visit to the Mistaire garden, which contains more than 80 species of native and cultivated ferns.

Dr. Ralph C. Benedict, chairman of the meeting, introduced the five speakers taking part in the symposium. Another scheduled speaker, Dr. Norman P. Marengo, was ill, but later sent the complete text, and photographs of his paper, "The Microscopic Structures of the Mature Spores of the Ostrich Fern, the Sensitive Fern, and the Royal Fern."

Mrs. Lenette Rogers Atkinson, in "The Developing Prothallus of *Anemia*," described the triradiate spores of three species of *Anemia* (Schizaeaceae), and showed lantern slides to illustrate the lateral meristem of the

gametophyte.

Dr. Edgar T. Wherry outlined his theories on "Hybrid Ferns versus Ancestral Ferns," using large charts to show relationships in *Dryopteris*.

Mrs. W. D. Diddell spoke on "The Spores and Sporangia of *Ceratopteris*," illustrating these interesting aquatic ferns with pressed herbarium specimens, photomicrographs, and projected microscopic slides.

Mr. F. Gordon Foster, discussing "The Microscopy of Fern Spores," demonstrated the correct use of the microscope and the effects of light and mounting media of varying refractive indices on spore detail.

Miss Clara S. Hires spoke on "Three-Dimensional Fern Spores," summarizing her basic beliefs on spore shape and construction. Spore models, photomicrographs and drawings from the Mistaire Laboratories collection added further support to her views, which differ from those generally accepted.

Miss Maud Mary Griswold, of the staff of Mistaire Laboratories, in "Models for Spore Study," stressed the value of models in learning and teaching about fern spores, and mentioned some of the technical and theoretical problems involved in model construction.

A highlight of the program was the new *SpeedMatic Micro-Projector*, kindly lent by Bausch and Lomb Optical Company and demonstrated alternately by Mr. Foster and Mr. Burton Dezendorf, of the American Optical Company. This instrument, which shows spores and sporangia magnified up to 2350 $\times$ on a screen, illustrated Mrs. Diddell's talk on *Ceratopteris* spores, and Mr. Foster's talk by showing the effects of different refractive indices on spore detail in *Osmunda* spores mounted in various media. These illustrations provided an excellent introduction to Miss Hires' subject.

Interesting exhibits included Mr. Charles Neidorf's photographs of fertile fronds, beautiful drawings of the



Plate III. Party at Symposium on Fern spores, left to right: Miss Emil Plate, Mrs. Elizabeth Valentine, Mrs. C. M. Van de Water, Dr. H. W. Rickett, Mrs. F. G. Dunham, Mr. F. G. Foster, Dr. C. M. Van de Water, Mr. B. Dezendorf, Mrs. C. Neidorf, Mrs. H. W. Rickett, Mrs. A. Doogan, Mrs. R. Atkinson, Mr. C. Neidorf, Mrs. E. Schaeffer, Mr. R. W. Hires, Mrs. T. Flitlet, Mrs. F. G. Foster, Mr. T. Flitlet, Miss E. Sobol, Mrs. B. Dezendorf, Mrs. M. W. Diddell, Mrs. H. Dole, Miss Clara S. Hires, Mr. B. Cobb, Mr. R. M. Lawton, Miss M. Griswold, Dr. R. C. Benedict, Dr. M. A. Johnson, P. Benjamin Allison, and Mr. W. Crotty.

Anemia story from spore to prothallus, *Anemia* prothallia cultured by Mrs. Atkinson, and Mrs. Diddell's *Ceratopteris* specimens. The Mistaire Laboratories exhibits included representative selections from the collections of photomicrographs, models, herbarium specimens, and slides of fertile pinnae sealed between glass, a method of sealing that preserves the color and freshness of specimens for at least a year, if the slides are stored under refrigeration for later study.

There was a large attendance for the meeting. Miss Hires was a gracious hostess for Mistaire Laboratories, which provided a delicious luncheon for the group.

NEW ENGLAND MEETING, July 15 and 16, 1955. The New England section of the American Fern Society met in Hanover, N.H., on the morning of July 15. Notices, with return post cards had been sent to 110 members, 74 in the New England states and the rest in the New York City and Hudson River valley region. 86 replied to the notices, 43 stating that they would attend if possible. There were 35 present at the meeting. The program was arranged by Professor James R. Poole, the head of the Botany Department of Dartmouth College and the meetings were held in his department. Mr. Harold Rugg was associated with Dr. Poole in planning the indoor part of the program and the field-trips.

The morning session was conducted by Dr. Poole and purposely planned to appeal to those less advanced in the study of ferns. Excellent kodachromes of the New England ferns, taken by Professor Charles J. Lyon, were shown on a screen and described by Dr. Poole. The life-cycle and growth of the fern was depicted by the use of class room models and charts. This was followed by a twenty-minute time lapse film of the development of ferns. In an adjoining laboratory microscopes were set up to illustrate some of the material presented. In another room, Mr. Charles Neidorf's enlarged photographs

of the fruiting portion of ferns and a mounted collection of pressed fronds, were displayed. Various plastic containers of live prothallia and sporelings were exhibited by Dr. Benedict. Also displayed was an unusual assemblage of fern books from Mr. Rugg's and the Dartmouth College library.

After lunch, Miss Clara Hires spoke briefly and gave an extensive demonstration of her three-dimensional spore studies, supported by meticulously prepared plastic models and beautiful spore photographs. Harold Rugg's fern and flower garden in Hanover was then visited. Many uncommon species, forms, and hybrids were inspected and discussed. Then there was a two-hour field-trip in a nearby bog in Vermont.

In the evening, Mrs. Lloyd Bugbee, of Bradford, Vermont, who for years has been interested in the conservation of plant life, showed her remarkable photographs of wild flowers in Vermont and New Hampshire in their natural settings. Subsequently, we had a short talk by Harold Rugg on an expedition in the British Isles that he had taken the preceding summer with members of the British Pteridological Society.

The next day, guided by Cyrus Darling, of Marlboro, Vermont, several districts west of Brattleboro were visited, including Mr. Darling's fern garden. About 30 varieties were seen in the field. Blackberries, raspberries, and two wood-thrush nests, containing eggs, provided diversion. The day was hot with some rain but 23 participants thoroughly enjoyed themselves—BENJAMIN R. ALLISON

REPORT OF FIELD-TRIP IN ONTARIO. The fascination of ferns drew members of the American Fern Society to the Bruce Peninsula in Ontario in early September, 1955. Botanists have long known the unique position that "The Bruce" holds in the plant world, and the announcement of the Society's four-day field-trip in this area brought

fern enthusiasts from such widely separated points as New York, Louisiana, Connecticut, Washington, D.C., and the Province of Ontario.

The group, under the leadership of Prof. James H. Soper, met at the Rocky Saugeen River, north of Durham, Ontario. Among the first to reach the rendezvous were Dr. and Mrs. Clair A. Brown and their two daughters from Baton Rouge, Louisiana. With the arrival of Dr. and Mrs. A. V. Smith, of Washington, D.C., and Richard G. Blackburn, University of Toronto student, the party numbered nine.

After lunch the group proceeded on foot along the south bank of the Rocky Saugeen River. We descended a rocky slope to see Green Spleenwort (*Asplenium viride*), Maidenhair Spleenwort (*A. Trichomanes*), Wood Fern (*Dryopteris spinulosa*), and Bulblet Fern (*Cystopteris bulbifera*). As we followed the path through the woods to the bank of the river, Dr. Brown was the first to spot *Selaginella apoda* growing in damp soil near a tiny stream. Crossing the river at the dam, we walked through a rocky wooded area along the shore where *Asplenium Trichomanes* was abundant along a rocky wall, and where we had our first view of the Hart's-tongue (*Phyllitis Scolopendrium*) growing among moss-covered rocks in a shaded grotto. On a large mound we saw *Lycopodium lucidulum*, Marginal Fern (*Dryopteris marginalis*), Walking Fern (*Camptosorus rhizophyllus*) and Polypody (*Polypodium virginianum*). Following the river downstream, we found nice stands of Maidenhair Fern (*Adiantum pedatum*), Narrow-Leaved Spleenwort (*Athyrium pycnocarpon*), and more *Phyllitis* in all stages of growth scattered for a hundred yards or more. We also observed Ostrich Fern (*Pteretis pensylvanica*), one plant of Silvery Spleenwort (*Athyrium thelypteroides*), and *Equisetum arvense* growing by the shore.

Just before returning to the cars we were hailed by a

party of three from Connecticut (Mrs. Muriel P. Brown, Mrs. Marion B. Rhodes and Eugene Rhodes) who had been held up by engine trouble enroute to the rendezvous.

Proceeding toward Owen Sound, the party stopped at Inglis Falls, where the Sydenham River tumbles over the Niagara escarpment. It was here in 1857 that the Hart's-tongue was first collected in Ontario by C. William Hincks, one of the earliest professors of natural history at the University of Toronto. Here, too, during the Botanical Society of America's trip in 1934, Prof. M. L. Fernald collected the type material he used for the American variety of Hart's-tongue. In the horizontal seams of dolomite, the Hart's-tongue is still flourishing. On the sloping talus of the lower glen, the evergreen Holly Fern (*Polystichum Lonchitis*) was found growing in close association with the Hart's-tongue. The Bulblet Fern (*Cystopteris bulbifera*) was luxuriant here, and fronds up to 30" in length were discovered. A few specimens of Fragile Fern (*Cystopteris fragilis*) were noted.

Now numbering twelve, the party proceeded to headquarters in Wiarton, Ontario, where we were comfortably quartered at the Pacific Hotel. Here we were joined by another member of the Fern Society, Dr. Mildred E. Faust, of Syracuse University.

The town of Wiarton, overlooking the blue waters of Colpoy's Bay, aptly terms itself "The Gateway to the Bruce Peninsula." The interesting topography of the Peninsula merits some description. The Niagara cuesta is, of course, the dominating geological feature. Chapman and Putnam give a clear picture of the topography of the Bruce when they state: "The dip of the rock strata is towards the west: the surface rises from the water's edge on the Lake Huron side towards the escarpments on or near the Georgian Bay shore, the highest bluffs on Georgian Bay being well over 200 feet in height." Thus is explained the interesting contrast be-

tween the two shorelines: the rugged beauty of the limestone bluffs and talus slopes of the Georgian Bay shore, and the tranquil scene of sandy beaches, limestone pavements and marshy tracts on the Lake Huron side. There are many lakes and swampy areas. Outcrops and ridges of grey dolomite are frequent; the limestone surface is irregular and often deeply creviced. Some farming is carried on, but the percentage of arable land is small; there is much stony pasture. A considerable portion of the land is covered in forest and there are many wild and unfrequented places. It seems a rather stern, uncompromising land by most standards. But its chief attraction lies in the fact that it is not yet completely overrun with the insignia of civilization. For the outdoor enthusiast—for the botanist and naturalist especially—the Bruce has a particular appeal. There are rocky forested areas of great beauty, wind-swept sand dunes, unfrequented marshlands, rough wild tracts of land that offer a challenge to the questing botanist. In his charming book, "The Bruce Beckons," Dr. W. Sherwood Fox writes: "Happily it seems to be true that most men, despite the stifling effects of modern life, still keep alive in their souls the race's rare power to perceive in any wilderness—however barren, unfriendly and unkempt—witcheries that beckon to quest and adventure. In qualifications of that order the Bruce is indeed extraordinarily rich."

With high anticipation, then, we looked forward to our first day in the Bruce Peninsula itself. In the morning we were joined by Vincent Elliott and Ralph Beacroft, of Wallaceburg, Ontario, and Mrs. Claire Davison, of Hamilton, Ontario, making a party of sixteen.

Dr. Soper's previous explorations and his careful planning served us well. At our first morning stop we saw several fine stands of Male Fern (*Dryopteris Filix-mas*) growing in open sun on the edge of a rocky wooded slope,

a station discovered by Dale J. Hagenah, of Detroit, who unfortunately was unable to be with us, although he took an active part in the planning of the excursion.

This might well have been called "Hart's-tongue Day," because we saw it in abundance in the forested area north of Hope Bay. The strap-shaped fronds were glistening green in the morning light. Following a prominently exposed limestone ridge we found Hart's-tongue with fronds 20 inches long, and Holly Fern with fronds up to 24 inches.

A deep curve in the limestone ridge, overarched with trees, formed a forest-cathedral where a chipmunk held up his little paws in prayerful attitude, wide-eyed at our intrusion. His rocky prayer bench was decorated with Walking Fern and Polypody. Knee-deep in Maidenhair (*Adiantum pedatum*), Marginal Fern (*Dryopteris marginalis*), Wood-fern (*D. spinulosa* var. *americana*), and Bracken (*Pteridium aquilinum*), we walked deeper into the wood where the rich soil of a damp hollow produced Sensitive Fern (*Onoclea sensibilis*), Silvery Spleenwort (*Athyrium thelypteroides*), Narrow-Leaved Spleenwort (*Athyrium pycnocarpon*) in fruit finally, and Rattlesnake Fern (*Botrychium virginianum*). Vincent Elliott held aloft a rare find—the brilliant-berried Ginseng (*Panax quinquefolius*). In this very rich locality we also saw Ostrich Fern (*Pteretis pensylvanica*) and after diligent searching Goldie's Fern (*Dryopteris Goldiana*).

Each day the hotel supplied an appetizing midday lunch. At the kind invitation of Mr. and Mrs. Vincent Elliott, we enjoyed our picnic in the grounds of their summer home near Stokes Bay.

In the afternoon, two stations of exceptional interest were visited along the provincial highway south of Tobermory. At the first stop, we saw the Purple-Stemmed Cliff-brake (*Pellaea atropurpurea*), growing in its accustomed limestone crevices. This fern is rare in

Ontario, *P. glabella* being the common species of the escarpment. At the second station, we were shown a single plant of Wall-Rue (*Asplenium cryptolepis*) growing in a dense little tuft not over three inches high, again on a limestone ridge. Standing guard over this rarity—as each of us in turn admired and photographed the tiny plant—Dr. Soper was heard to remark: “*Asplenium cryptolepis*—one plant—much handled, much photographed, but *not* depleted!” The discovery of this station¹ was made by Dr. M. T. Hall, of Cranbrook Institute of Science, while botanizing with Mr. and Mrs. Hagenah on November 3, 1950. Nearby, both the Maiden-hair Spleenwort (*Asplenium Trichomanes*) and the Green Spleenwort (*A. viride*), as well as *Equisetum scirpoides* were growing on a shaded limestone ledge.

Proceeding to the sandy shores of Dorcas Bay, Lake Huron, we were charmed by the view and the wealth of flowering plants. The delicate blue of Kalm's Lobelia (*Lobelia Kalmii*) vied for our attention with the little pink Gerardia (*Gerardia paupercula*), the pure white flowers of Grass of Parnassus (*Parnassia glauca*), and the blue of the Fringed Gentian (*Gentiana procera*). The Dwarf Lake Iris (*Iris lacustris*) native of the Lake Huron shore, had finished blooming, but Pitcher-Plants (*Sarracenia purpurea*) abounded, as well as Sundew (*Drosera linearis*). Here we added Marsh Fern (*Dryopteris Thelypteris* var. *pubescens*) and Royal Fern (*Os-munda regalis*) to our fern list as well as *Equisetum variegatum*. The fragrant Ladies Tresses (*Spiranthes Romanzoffiana*) was in flower as was the False Asphodel (*Tofieldia glutinosa*), another native of the Lake Huron shore. Truly our first day had been rich indeed in the plant treasures of the Bruce!

On Friday, September 2nd, a visit to Dyer's Bay was planned for the purpose of exploring the limestone cliffs

¹ This station adds one hitherto unreported locality to those recorded by J. H. Soper, This JOURNAL 45: 97-104. 1955.

on the Georgian Bay side of the peninsula. Mr. Vincent Elliott assisted Dr. Soper by leading this expedition. In this area, an unusually large Leatherwood Tree (*Dirca palustris*) was inspected with great interest. Leaving the cars, we proceeded on foot along a little-used trail through a deciduous forest. As we emerged at the edge of the cliff, we had an extraordinarily beautiful view of blue Georgian Bay and white limestone bluffs circling the shoreline. Immediately below us was The Monument, a huge pillar of stratified stone eroded from the craggy face of the cliff. We descended to the water's edge by way of an old iron stairs and the talus slope, and rested on the cobblestone beach before ascending the cliff again the hard way.

A damp cavity in the rock was festooned with Bulblet Fern. Further climbing around the boulders on the talus slope revealed large green tufts of Maidenhair Spleenwort. As we climbed higher, we found the Slender Cliff-Brake (*Cryptogramma Stelleri*) hidden in crevices of the perpendicular rock face. The ascent of this last bluff required some careful and determined climbing, but the assistance of the leaders turned this hazard into a "mission accomplished" when all scrambled to the top without incident.

Returning through the woods we found a single plant of Christmas Fern (*Polystichum acrostichoides*), as well as Holly Fern (*P. Lonchitis*) and other ferns seen previously. The strange and beautiful Earth-stars (*Geaster* sp.) compelled our attention, their star-like forms being in various stages of development.

After lunch in the woods, we drove northward to within a few miles of Tobermory where we secured permission to visit a dry blueberry bog, the only locality given by Krotkov (1940) in the Bruce Peninsula for the Chain Fern (*Woodwardia virginica*). It was found easily, along with characteristic bog plants such as cotton-grass,

leatherleaf, sheep-laurel and labrador tea.

The weather during these September days was mild with clear sunny skies. Such a day was Saturday for our final field-trip. We drove along the Oxenden Road toward the Bruce Caves, getting some fine views of the sparkling blue waters of Colpoy's Bay and its rim of white bluffs. While proceeding toward the Caves on foot, some of the party observed a porcupine at close range, and others had a fleeting glimpse of a red fox. Holly Fern and Maidenhair Spleenwort were abundant in the rocky woods and Polypody enlivened the mossy slopes. Near the cave entrance several dense masses of Walking Fern covered huge boulders. An exploration of the cliff face produced the Slender Cliff-Brake (*Cryptogramma Stelleri*).

Our second stop was near Oliphant, where a stony pasture contained a great colony of the interesting plant appropriately called Woolly Lamb's-ears (*Stachys olympica*). Both upper and lower surfaces of the leaves are thickly felted with a soft down of white wool, giving the plant a grey appearance. At this season only a few of the purple florets of the flower spike were to be found. But they gave an indication of the attractive picture the colony would present in summer, with the dense spikes of purple flowers amid the grey foliage. This plant is a native of the Caucasus Mountains of the Old World, and Bruce and Grey counties in Ontario represent one of its few known areas in North America.

In our short drive across the peninsula we had exchanged the cliffs on Georgian Bay for the sandy shores of Lake Huron, and our sights were trained on Sauble Beach, where a damp basin between the sand dunes was a previously reported² habitat of *Schizaea pusilla*. Here, amid a profusion of Fringed Gentian, pink Gerardia, Kalm's Lobelia and Ladies Tresses, one and all searched

² This JOURNAL 35: 40. 1945.

diligently for the Curly Grass Fern. Our combined efforts, however, were unsuccessful: *Schizaea* eluded us.

It was at this point that our congenial party regretfully disbanded. All voiced warm appreciation of Dr. Soper's excellent arrangements for our pleasure and comfort. His familiarity with this region and its flora enabled him to plan daily trips that were both interesting and varied. As a member of the party, I can testify to the enthusiasm and appreciation which pervaded the entire group. Altogether 31 species of pteridophytes were observed during the four-day excursion, and photography occupied the group rather than collecting. The success of this excursion encouraged us to hope that a similar trip may be planned another year.—EDITH AUSTEN LLOYD.

Letter from the President-elect

Dear fellow members of the American Fern Society:

You have honored me by electing me to serve as president of the Fern Society through 1956. This honor, and the responsibility it carries, somewhat appall me when I contemplate the tremendous amount of work invested in our Society by my immediate predecessor, Dr. Benedict, and by the loyal officers who served with him. It is my great fortune to be able to rely on them during my tenure of the office, but it is my hope that at the end of 1956 they will not feel that the total burden has been shifted to their shoulders!

As you know, our Society has cooperated with other organizations during recent years in sponsoring symposia and sessions for the presentation of contributed papers during the annual meetings of the American Institute of Biological Sciences. In 1956 the A.I.B.S. meets on the campus of the University of Connecticut. Almost simultaneously with notification of my election as president, arrived a request from Dr. Hiden Cox that I designate

an official representative of the Fern Society to serve on the Local Committee at the University of Connecticut. Unfortunately, there seems to be no member of our Society living on the Connecticut campus. However, Dr. Wendell H. Camp has consented to look out for the interests of the American Fern Society during the deliberations and planning of the Local Committee while it is making arrangements for the August, 1956, meetings of the A. I. B. S. Papers for presentation at this meeting are very much needed; will members, and others with papers to present please send the titles without delay to the Secretary, Dr. Mildred E. Faust, Department of Botany, Syracuse University, Syracuse, New York.

It is not possible for me to promise to attend all of the meetings, field-trips, or forays of the Fern Society, but I will make a strenuous effort to attend the meetings of the A.I.B.S, and I hope to have the opportunity at that time to meet many of you and to discuss ways and means of furthering the objectives of the American Fern Society.

In the meantime, I wish to express here my high regard for the self-sacrificing manner in which Dr. Benedict devoted many hours of hard work in furthering the interests of the Society. His friendly letters to many members, his close participation in most of the field-trips, his willingness to lend aid to tyro and to specialist alike, and his unfailing devotion to any effort that would improve the Journal or increase our knowledge about ferns has been an inspiration to all of us. I wish that it had been practicable for him to continue as the President of the American Fern Society. Since he feels that he can not do this, it is my wish that he may find great satisfaction in the splendid work he has done for the Fern Society and that he will reap great benefits from the time he will have free to devote to those efforts that have appealed to him but for which he has lacked time or energy.

It is with humility that I take up the duties and responsibilities of president. At the same time, I consider myself very fortunate to have a group of such capable officers to help run the affairs of the Society, all of them people who have behind them the experience of several years of working with and for the Fern Society.

In closing this, my first communication addressed generally to the membership of the American Fern Society, I wish to make two requests. First, I would like to urge that each member attempt to interest one or more others to become regular members of the Fern Society. Increasing our membership will help solve the problems attending publication of the Journal. Second, I suggest that each member be alert to any observation or discovery relating to ferns or fern-allies that may not be generally known by other members. Often the commonplace in one individual's experiences may be an exciting episode to a member living half way across the continent—or in the next township. Who knows? If these observations and discoveries are written out and the paper submitted to the Editor, your efforts will enable him to select additional material for the pages of the Journal. Mr. Morton will usually know whether or not a particular item has been published previously, and will welcome contributions of carefully written manuscripts from amateur and professional botanist alike. A larger membership will make possible a larger Journal, and more numerous papers submitted for the Editor's consideration will permit inclusion of more pages in the Journal. The two suggestions aim at one and the same ultimate goal.

I look forward to an enjoyable, profitable year for the American Fern Society, and hope that it will bring happiness and increased satisfaction to each of its members.

Very Sincerely,
IRA L. WIGGINS

PROSPECTIVE FIELD-TRIPS IN 1956

APRIL 25-28. Dr. A. J. Sharp wishes to call attention to the Sixth Annual Spring Wildflower Pilgrimage in the Great Smoky Mountains. There will be one tour especially devoted to ferns and mosses, several for birds, and some indoor meetings in the evenings. If interested, write to the Gatlinburg Chamber of Commerce, Gatlinburg, Tennessee, which sponsors the program.

JULY (probably). Dr. B. R. Allison, Chairman of the New England Committee, suggests a possible two-day meeting near the junction of Connecticut, Massachusetts, and New York, with perhaps the famed Bartholomew's Cobble as one place to visit. Inquiries should be addressed to him at Hewlett, New York.

The August, 1955, number of the magazine "Friends," contains two pages of pictures of the Fern Society field-trip to Haines Falls, New York (reported in Volume 45, no. 1, p. 42). Several of our well-known members are recognizable, including Dr. R. C. Benedict, Dr. E. T. Wherry, and Miss Helen Bristow.

For current work on the genetics of *Asplenium*, Dr. W. H. Wagner, Jr., Department of Botany, University of Michigan, Ann Arbor, Michigan, is in need of spores of *A. Bradleyi*, *A. montanum*, and *A. platyneuron*. Members are urged to supply these during the coming season if possible.

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American Fern Journal

A QUARTERLY DEVOTED TO FERNS

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EDITORS

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A. C. SMITH

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The American Fern Society

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Plants of the Tree-Trunks in Liberia

WINIFRED J. HARLEY¹

Plant life in a tropical rain-forest is abundant and varied. Every sort of locale furnishes a place for some type of vegetation—the rocky stream beds, the sunny cliffs, the forested slopes, and the fertile valleys. Some plants flourish in the black mold, some on the wet rocks, and some on the forest trees themselves. Indeed a marvelous variety of species is at home on the lower portions of the tree-trunks in the moist warm forest.

“Mossy tree-trunks” is a triteness which can hardly be avoided. They are mossy in Liberia! And what an abundance of mosses is to be found on these trees where warmth and moisture are present all year round! Some mosses cling like a close thick felt; others have “leaves” arranged in stiff little rosettes; there are mosses whose

¹ Mrs. Harley is the author of the valuable recent paper “The Ferns of Liberia” (Contributions from the Gray Herbarium, no. 177, pp. 58–101. 1955), which discusses the physical features of Liberia, the botanical collectors, the ecology of the ferns, and concludes with an annotated catalog of the species. Liberia is not rich in ferns, for a tropical country; the only previous list, by Dinklage (1937) contained 45 species of ferns and fern-allies; the number is increased to 118 in the present list. There are quite a number of species that are common to Liberia and the American tropics, among them *Hymenophyllum ciliatum*, *Dryopteris dentata*, *D. protensa*, *D. quadrangularis*, *Nephrolepis biserrata*, *Microlepia speluncae*, *Asplenium formosum*, *Pityrogramma calomelanos*, *Adiantum philippense*, *Histiopteris incisa*, *Pteridium aquilinum*, *Polypodium duale*, *Acrostichum aureum*, *Osmunda regalis*, *Lycopodium carolinianum*, *L. cernuum*, *Psilotum nudum*, and perhaps others. Many of these are, of course, widespread species, but others are more restricted, and do indicate a rather close relationship between these two distant areas.—C. V. M.

shoots look like miniature ferns, a gray-green species that forms thick soft cushions. And each, of course, bears its own distinctive fruit.

The liverworts, small brothers of the mosses, are usually overlooked except by the botanist. They come in a great variety of forms, intermingled with the mosses on our trees. Some are shapeless blobs of green protoplasm, unexpectedly rearing an arm with granules of reproductive tissue. Other species might be mistaken for a very fine type of moss, with their microscopic strands woven in and out over all the other small plants of the tree-trunk community.

Probably the commonest plants are the lichens. It would be hard to find a tree anywhere on which no lichens are to be seen. One is a crisp-curved, silvery, shell-like plaque, frilled and fluted with infinite delicacy, and studded with flower-like structures, each with a flat, brown crater. Another sort is less cut and curled, and its fruiting discs are surrounded by lips that bear sparse, black hairs. A ragged smoke-colored, low-fruiting species covers the twigs like sooty cobwebs. There are gray-beard tufts—dry and unreal looking, and irregular blotches that form areas on the bark like spots of splashed paint—gray, brown, and mauve. The lichens are everywhere.

Flowering plants also find favorable homes on the trunks and lower branches of the forest trees. Very many of the tropical orchids grow there—far too many for any listing. *Bulbophyllums*, *Polystachyas*, and others grow in clumps where rough bark or a limb's crotch gives them a footing. *Vanilla* and other coarse-leaved kinds drape and festoon themselves from the branches, sending out thick air-roots seeking moisture and support. The blossoms of these West African orchids are usually small, without showiness or brilliance; but what an amazing and fantastic perfection of tiny

parts they display under the magnifier!

Among the smallest and most delicate of flowering plants are the Utricularias. Some species grow floating in still pools, in a tangle of stems buoyed up by little bladders, holding their tiny flowers above the water. Other species grow on soil or moist rock and a few are found on mossy tree-trunks. The blossoms, borne on stems as slender as a hair, are as tiny and fragile as a gnat's wing. The few leaves, almost lost among the mosses, may be only one-eighth of an inch across.

Contrasted with these little plants, which must be looked for carefully, the members of the arum family with their large leaves can hardly be missed even by a careless observer. Anywhere from the lower few feet up to the higher stretches of the trunk, these plants climb and hang out their banners. The aroids are familiar to every child who has roamed the spring-time swamps of New England through their representative, the Jack-in-the-Pulpit. Among our tree-dwellers, the spathe-and-spadix blossom is usually green and inconspicuous, but sometimes the fruits make red or orange bunches among the leaves. The largest species has leaves like the sole of a number 12 shoe. Others have leaves pointed like arrow-heads, or heart-shaped, or oval.

Among all the members of the tree-trunk community, none is quite as fascinating as the ferns. On saplings, on forest giants, or on the loops of woody vines, they delight the eye of botanist and layman alike. The large forest trees, with their countless individual leaves and twigs, act as reservoirs for the rain-water and the condensation of fog, and by a slow gradual trickling and seepage down along the larger branches to the trunk, their vast and lofty crowns maintain long steady periods of constant moisture to the lower parts of the trunks. It is this supply of moisture that enables the mosses, ferns and other plants to grow there.

Some great trees are clad with a thick rich growth of the moss-like "filmy-ferns"—species of *Trichomanes* and *Hymenophyllum*. The smallest and simplest of these have fronds no larger than the nail of a lady's fifth finger, each bearing a single goblet-shaped fruiting-body at its apex. The local representative of these tiny ferns is *Trichomanes liberiense*. Other species only slightly larger have several lobes, fingers, or branches, some of which bear fruits. Two species of *Hymenophyllum* grow here. All leaves of these ferns are a single cell-layer in thickness. During times when moisture is scarce, they curl up, presenting a minimum of surface to the dry air, and expand again when soaked by the next rain.

Perhaps the commonest ferns of the tree-trunks are the *Aspleniums*, those most commonly found along the lower trunks being rather delicate and lacy. They include *A. Geppii*, *A. hemitomum*, *A. Barteri* and *A. Dregeanum*. In the last-named, the individual clusters of fine sprays are joined like links of a green chain by slender fronds which reach out from the mother plant, develop rootlets at their tips, and, anchoring in a bit of wet moss, form new plants to continue the chain.

There are two species of *Nephrolepis*, relatives of the Boston fern, and an *Arthropteris* which somewhat resembles them in appearance. These all climb by means of a slender running root-stock. In very wet places the coarse *Stenochlena guineensis* attaches itself by thick clinging roots, and puts out its two kinds of fronds. There are the grass-leaved *Vittarias*, whose young fronds show rosy pink as they unroll, and whose fruits form a line like brown braid along the edge of the narrow fronds.

On some trees there are species from the *Polypodium* group, with their round fruit-dots. *Polypodium lycopodioides* with its soft scaly rootstock and its neatly placed oval leaves is often seen at the lower levels, and

also the lance-shaped *P. Loxogramme*. Somewhat higher, often out of easy reach, we may find the small hairy *P. villosissimum*, and the notched blades of *Xiphopteris serrulata*. There are the very un-fernlike, leathery leaves of three or four species of *Elaphoglossum*, and occasionally the broad thin fronds of *Antrophyum*, whose fruit lines trace out a net-work of veins. Much larger and coarser than any of these, *Polypodium scolopendria* flaunts its fronds, simple or many-lobed, bearing fruits in large brown spots.

Drynaria Laurentii pushes large, green, divided leaves out from a base protected and sheathed by thin papery blades shaped like oak-leaves. Here and there, in a favorable lodging place, there is a massive *Platycerium* plant, or a whole colony overlapping and intergrown. Like *Drynaria*, it has special fronds at the base whose purpose seems to be holding moisture and humus for nourishment. From the center the huge fertile fronds arise, branching once and again in the "stag-horn" fashion, and bearing on the outer parts great brown patches of fruiting structures. All of these large ferns may be found both in the upper branches of the trees and on the trunk closer to the ground.

The tree-dwellers in this belt of heavy rainfall flourish best and most abundantly in the virgin forest, which persists chiefly on the rocky slopes of the broken mountain country, where the ferns, mosses, lichens, and liverworts, and the flowering epiphytes clothe the trunks of the forest trees. It has been my good fortune to become familiar with this country. Returning on each vacation period it is satisfying and refreshing to find the familiar species on the trees along the path, and it is a pleasant thrill to discover one of the less common ones.

GANTA MISSION, MONROVIA, LIBERIA.

More Hart's-Tongue in Michigan

DALE J. HAGENAH

The first known Michigan station for the American Hart's-Tongue (*Phyllitis Scolopendrium* var. *americana*) was found near Trout Lake, Chippewa County, in July, 1953, as previously reported.¹ The discovery of that small group of plants, only eight in all, immediately raised the question of whether they represented an unrecorded introduction by some fern enthusiast or whether they were the remnants of a formerly larger colony, a view which seemed to be supported by the situation and the associated vegetation. If there had been a larger colony here, were there others somewhere along the Niagara formation in Michigan? That region became the most interesting in Michigan so far as I was concerned, and many hours during the winter season of 1953-54 were devoted to a study of the geological literature dealing with it. Between Trout Lake and Drummond Island, where the Niagara formation enters Michigan, I found that the Niagaran rocks were exposed in a range of rather conspicuous hills on which northern hardwoods were, or had been, the principal forest type. *Polystichum Lonchitis* and other species known to occur in the Bruce Peninsula of Ontario, where the American Hart's-Tongue reaches its greatest abundance, were already known to occur in this part of the state. Additional interest was focused on this section by a letter from a local resident who thought that she and her husband had seen Hart's-Tongue while deer hunting, although they could not remember the location.

In the end, Mrs. Hagenah and I set aside two weeks in August for the search, and Dr. Marion T. Hall, discoverer of the Trout Lake plants, agreed to join us for a

¹ This JOURNAL, 44: 2, 1954.

few days. As a start, we revisited the Trout Lake area, where we found the plants at the original station to be larger and more healthy appearing than in 1953. Although we spent two days in combing that vicinity, we found no more Hart's-Tongue, but we did find *Cryptogramma Stelleri*, not previously reported from the eastern part of the Upper Peninsula. We moved on to Cedarville, where Dr. Hall and his family joined us, and spent the next few days exploring the hills in the vicinity of Rockview.² New stations were found for such interesting species as *Asplenium viride*, *A. Trichomanes*, *Camptosorus rhizophyllus*, *Dryopteris Robertiana*, *Polystichum Lonchitis*, and *Polypodium virginianum*. However, although some of the woods seemed well suited to Hart's-Tongue, none was found. Next we turned our attention to Drummond Island, but, in the areas where the roads could be negotiated without danger to the oil pan and other under parts of passenger cars, we found the rock outcrops to be situated in terrain much too dry for Hart's-Tongue.

After we returned to the mainland, the Halls left to do some collecting along Lake Superior while we scouted farther north and returned to Cedarville. Our correspondent had planned to take us to several places where she and her husband thought that they might have seen the ferns or which they thought might be likely territory. In the end, both they and some friends whom they had interested in our quest, kindly acted as our guides. On the next to last day of our stay, under the guidance of two brothers, one well past eighty, who had hunted the countryside since boyhood, we visited a rocky hill-country penetrated only by logging trails. Here we found some fine old hardwoods, among the best we had seen in that region, and after hiking inward more than a mile, we

² The area visited by the 1953 Michigan Foray group to see *Asplenium viride* and *Camptosorus rhizophyllus*.

reached a bluff of Niagara rock in thick woods. On this north-facing bluff we found the Slender Cliff-Brake (*Cryptogramma Stelleri*) to be abundant, and on great rocks at the base of the bluff were numerous colonies of Walking Fern (*Camptosorus rhizophyllus*), by far the best stands of both species that we had ever found in Michigan. Along the trail we noted Maidenhair Fern (*Adiantum pedatum*) and Goldie's Woodfern (*Dryopteris Goldiana*), while along a low escarpment along one boulder-studded hillside were more Walking Fern, Northern Holly-Fern (*Polystichum Lonchitis*) and a real surprise, Braun's Holly-Fern (*Polystichum Braunii* var. *Purshii*). So far as I have been able to learn this is the first time that this beautiful fern has been found growing on rocks of the Niagara formation. The discovery of a new station for this unusual fern could not turn our attention from Hart's-Tongue, but once again although the woods seemed eminently suited to it, we came away disappointed.

The next day, which was the last we could spend in the Upper Peninsula on this vacation, we paid a visit to a well-known fossiliferous limestone area near Raber, on the chance that here near the St. Mary's River, which is at this point more like a lake than a river, conditions might be similar to those near Georgian Bay in the Bruce Peninsula. The woods which we penetrated proved to be second-growth and not at all suited to Hart's-Tongue because of the dryness of the situation. However, we did find some very robust *Dryopteris Robertiana* and some *Asplenium viride*. All day, as we drove to Raber and as we turned back west to reach St. Ignace, we had tried to compare the Hart's-Tongue stations that we knew in Ontario with the areas we had visited along the Niagara formation in Michigan, searching for clues that might lead us to the elusive fern or explain its absence. At last we realized that we had seen little of one of its

most frequent Ontario associates—Herb-Robert (*Geranium Robertianum*). At about the same time we remembered that the previous day was the only time when we had seen much of it, and that in the area where the two Holly-Ferns were growing. We had seen such good indicators as limestone, mature hardwoods, Northern Holly-Fern, Walking Fern, but no Hart's-Tongue. Then we remembered that, like many of the Niagaran bluffs in Michigan, this one faced north while many of our Bruce stations were on east-facing slopes, and the Trout Lake plants were on a west-facing slope. By any chance did the little escarpment where we had seen the Holly-Fern and Herb-Robert extend around the hill so that it would have either an east or west exposure? There was still time for us to reach the area and have two or three hours of daylight. As fast as the roads would permit, we hurried to the place where we had parked the previous day and then made our way to the spot where we had found the Holly-Ferns.

A bluff not over ten feet high extended along the hillside a little below the summit of the hill while huge boulders and slabs of rock lay close to the base of the bluff, and a belt of smaller boulders spread out into the woods on the nearly level ground of a small plateau. Painstakingly, we began to search this area eastward along the bluff. Mrs. Hagenah explored the boulder belt while I climbed over and around the large boulders and along the foot of the bluff. We tried not to miss any side of the rocks and to look in all large crevices. As we proceeded, it became evident that the rock formation did turn to the south around a shoulder of the hill. Suddenly, Mrs. Hagenah announced that she had found Hart's-Tongue. I hurried over and saw one smallish plant on the side of a mossy boulder. We marked the location well and continued our search. Before long we found much larger plants, some with fronds a foot in

length. Not only were there many large plants scattered over a considerable area, but in the moss on the boulders there were numerous small plants of all sizes. The hunch had been right, and Herb-Robert had led us to the place that we had been seeking for two weeks. As we made our way out to the logging trails to establish landmarks by which we could return again, we realized that on the previous day we had been not more than a hundred yards from the edge of the Hart's-Tongue area. By this time it was beginning to get dark in the woods, but we tried to determine the extent of the stand. The area was irregular in shape, but I paced along the principal axis and at right angles to it in two places and estimated that it might occupy as much as five acres.

We got off the back roads just before darkness overtook us and hurriedly changed our plans as we drove into the nearest town, Hessel, some twelve miles to the southeast. However, all thoughts of delaying our return home by even half a day so that we could have a few more hours for exploration were ended by a heavy rain which began during the night, making it impractical to try to use some of the rather primitive back country trails, and leaving unanswered the question of whether there were additional Hart's-Tongue colonies along other ridges in the same woods. At least we were sure that this real rarity among American ferns was definitely entitled to a place in the native flora of Michigan, for this large and healthy stand was located in a remote forest area. If it had not been for the interest of our North Country friends, it is doubtful that we would have ever chanced upon the right logging trail which led us to it.³

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³ The single plant which was brought back from the new station is growing in the University of Michigan Botanical Garden. Dr. W. H. Wagner has determined its chromosome count to be $2n = 144$, the same as in plants from the Bruce Peninsula.

Asplenium ebenoides $\times$ platyneuron, a New Triploid Hybrid Produced under Artificial Conditions

WARREN H. WAGNER, JR.¹

During the past several years the species and hybrids of the Appalachian *Asplenium* complex have been compared cytologically, morphologically, and anatomically.² These studies have provided more clear-cut evidence of relationships in the group than has heretofore been available. In particular, the information now suggests the hypothesis that eight known taxa, including such familiar plants as *Asplenium bradleyi*, *A. pinnatifidum*, and *A. trudellii*, arose as a result of reticulate evolution, i.e., through the coming together of the respective germ-plasms of three basic and ancient species—*A. montanum*, *A. platyneuron*, and *A. rhizophyllum* (*Camptosorus rhizophyllus*). If this general hypothesis of relationships in the Appalachian *Aspleniums* is valid, then three of the taxa reported in the wild, namely *A. bradleyi* $\times$ *montanum*, *A. bradleyi* $\times$ *platyneuron*, and *A. trudellii* (*A. montanum* $\times$ *pinnatifidum*),³ must be regarded as backcross hybrids. And if it is correct that the three basic parental species are but distantly related, then the chromosome behavior of these natural backcrosses may be expected to be distinctive, with the characteristic formation of 36 *pairs* of chromosomes (bivalents) and 36 *single* chromosomes (univalents) during the meiotic process preceding spore formation. Approximately these

¹ This is one of a series of studies carried out in part with the aid of a grant from the H. H. Rackham School of the University of Michigan. I wish to express thanks to Mr. Walter F. Kleschmidt for cultivating the plants at the University of Michigan Botanical Garden.

² This JOURNAL, 43: 109–114, 1953; and “Reticulate Evolution in the Appalachian *Aspleniums*,” *Evolution* 8 (no. 2): 103–118, figs. 1–8, pl. 1.

³ All three of these taxa are figured in Wherry, E. T., *Guide to Eastern Ferns*, ed. 2, pp. 127 and 131.

numbers have actually been found in *A. trudellii*, the only one of the three backcrosses which has been observed cytologically. Because of their radically unbalanced chromosome situation, it can be concluded theoretically that none of the backcross hybrids should be able to exist in a fertile state. They should always be found as single plants; and if they are discovered in large numbers it may be expected that some form of vegetative reproduction must be operative. Thus it is possible that *A. trudellii*, wherever it occurs as a locally common plant, may be capable of some form of reproduction, as yet undiscovered, that does not involve ordinary sexual means. In the investigations of Appalachian *Aspleniums* made thus far, the writer has been unable to obtain living plants from nature of either *A. bradleyi* $\times$ *montanum* or *A. bradleyi* $\times$ *platyneuron* because of their excessive rarity. Any plants of either of these entities are greatly desired for cytological examination.⁴

In this paper I wish to report a somewhat unexpected backcross hybrid in this complex, a hybrid which has not been discovered previously, and which, in fact, from our present knowledge of one of the parents, has very little likelihood of ever being discovered in the wild, except possibly in one small area in Hale Co., Alabama. This new backcross hybrid—*Asplenium ebenoides* $\times$ *platyneuron*—is of special interest, because we at present know considerably more of the relationships of the three taxa involved in its formation than we do of the other members of the Appalachian *Asplenium* group. The following relevant facts are known: (1) *Asplenium ebenoides* is the morphological intermediate between *A. platyneuron* and *A. rhizophyllum*; (2) it was produced

⁴ A trip was made by the author to the Blairsville area in New Jersey, where *A. bradleyi* $\times$ *montanum* occurred in a fine large stand discovered by Dr. Wherry some years ago; but the colony had disappeared, and a grape-vine has climbed over the rocks where formerly it grew.

artificially by crossing the latter two species in culture by Slosson⁵; (3) several plants of *A. ebenoides* from Montgomery County, Maryland, revealed that spore abortion in sterile individuals of the hybrid was due to the complete non-pairing of the chromosomes, so that 72 univalents are visible in meiotic metaphase; and (4) there is one population of fertile plants at Havana Glen, Hale County, Alabama, in which normal spore production occurs, and in which the chromosome number is double that of the sterile form of *A. ebenoides*. The fertile Alabama plants are thus typical *allopolyploids*, the chromosomes of the original sterile hybrid ancestor having been doubled, so that normal chromosome pairing at meiosis became possible by duplication of chromosomes. Our position is therefore stronger in the case of *A. ebenoides* than in the cases of *A. bradleyi* and *A. pinnatifidum*, the sterile forms of which are still not known, to state with certainty that the plant in question is of hybrid origin: it has been produced experimentally in culture, and the only fertile population has double the chromosome number of the sterile ancestral hybrid.

The new backcross, *A. ebenoides* $\times$ *platyneuron*, involved the fertile form of *A. ebenoides*. It appeared in a mixed culture of gametophytes of the respective parents. The original culture of gametophytes of the fertile form of *A. ebenoides* was kindly supplied by Miss Clara S. Hires of the Mistaire Laboratories. The plants were grown on nutrient agar, and were transplanted to soil in a low, square pot next to living sporophytes of *A. platyneuron* from which spores were being discharged. As it developed, although there were other species of *Asplenium* in the near vicinity, only the contaminating spores of *A. platyneuron* germinated in the culture of *A. ebenoides*. Even in the early stages of the growth

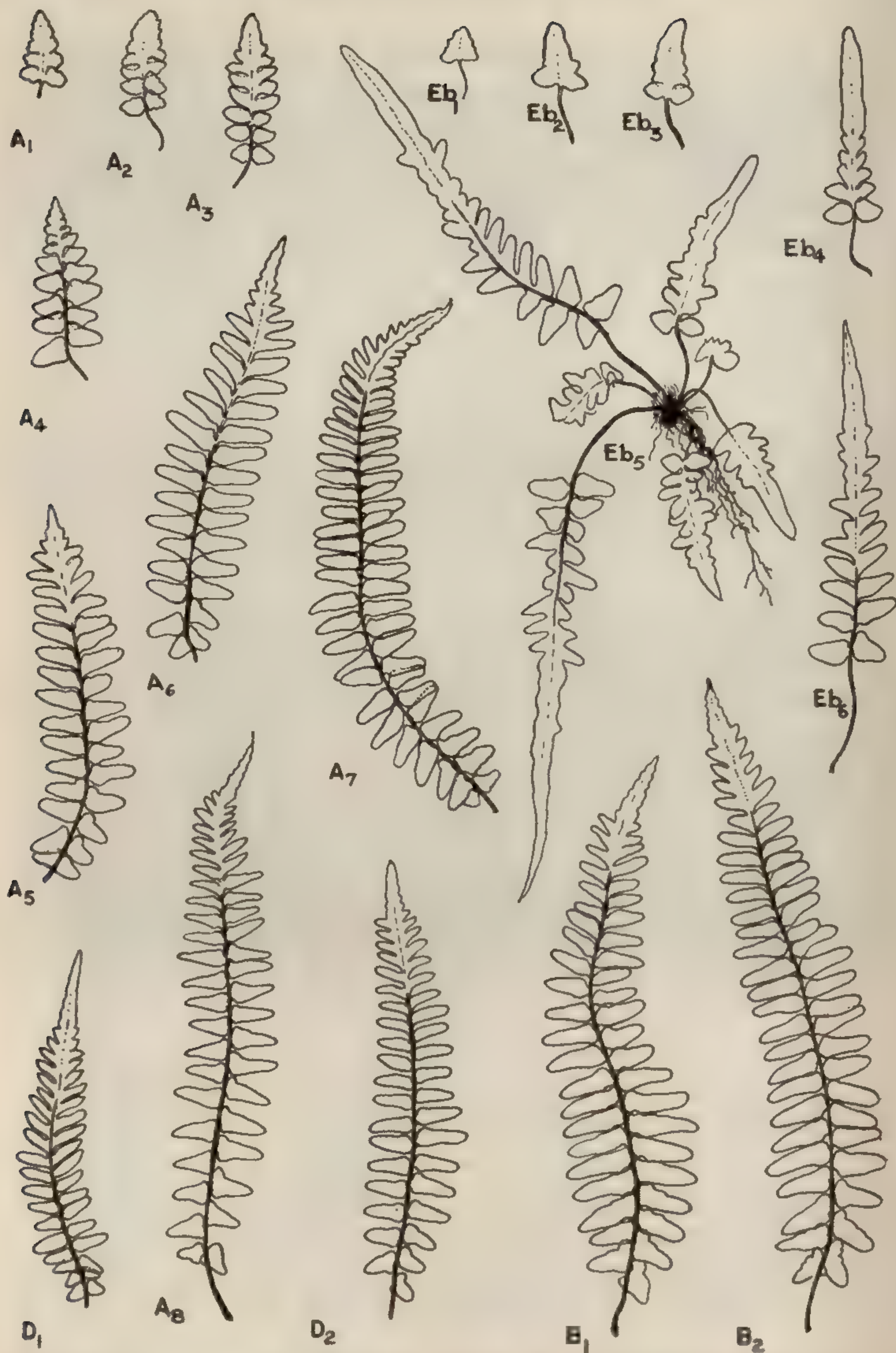
⁵ Slosson, Margaret. The origin of *Asplenium ebenoides*. Bull. Torrey Bot. Club 29: 487-495. 1902.



ASPENIUM EBENOIDES X PLATYNEURON

of the young sporophytes which formed in the mixed culture of gametophytes, it was possible to distinguish readily between *A. ebenoides* and *A. platyneuron*. It was also evident quite early in the growth of the young plants that, of the approximately 200 plants present in the culture, ten of the young sporophytes were intermediate between these two species. We concluded at the time that backcrossing had occurred. The intermediate plants were, therefore, separated from the rest and were grown individually in pots and studied. According to relative size, they were marked with letters—"A" for the largest intermediate specimen, "J" for the smallest. In the progression to more and more adult-type leaves, it became clear that the plants retained their intermediate morphology at all stages; later cytological study revealed good evidence that backcrossing had, in fact, produced them. That hybridization occurred in this mixed culture was probably due in part to the fact that the gametophytes of *A. platyneuron* were younger for the most part than those of the *A. ebenoides*, so that the gametangia of the respective species were more likely to be of opposite sex, the younger plants of *A. platyneuron* antheridial, the older ones of *A. ebenoides* archegonial. The first intermediate plants were noticed around the middle of July, 1954, and by November, 1954, the largest plants had begun producing sori. By the summer of 1955, some of the plants were forming fronds up to 30 cm. long and 4 cm. wide. Specimens from "Plant B" are shown in *Plate IV*.

Asplenium ebenoides $\times$ *platyneuron* is readily distinguishable from *A. ebenoides*, as shown in *Plate V* (cf. *figs. A, B, and D, with fig. Eb*). The new hybrid possesses a stipe only one-half or less the length of that in *A. ebenoides*. In medium-sized fronds of the backcross, the stipe length varies from 0.5–1.5 cm. The blade of the new hybrid, on the other hand, is relatively longer



A, B, D. FRONDS FROM DIFFERENT PLANTS OF *A. EBENOIDES* × *PLATYNEURON*,
NUMBERED FROM YOUNGER TO OLDER; Eb. A PLANT AND SEVERAL FRONDS OF
A. EBENOIDES, HALE CO., ALABAMA, GROWN IN CULTURE.

than that of *A. ebenoides*, where the over-all length of the fronds compared is the same. The most conspicuous feature of the new backcross is the large number of well-developed segments, the large fronds having up to 25–35 segments on a side in contrast to typical *A. ebenoides* in which the segments generally number only two-thirds or one-half as many. The cutting of *A. ebenoides* $\times$ *platyneuron* is much more regular or symmetrical than that of *A. ebenoides* (as was found to be the case in *A. truddellii* vs. *A. pinnatifidum*). In *A. ebenoides*, medium- and large-sized fronds are usually conspicuously irregular, with large segments next to small, and segments of different shapes. In contrast, irregularities of any sort were extremely rare in the backcross. The lower part of the blade of the backcross resembles *A. platyneuron* quite closely, and without the characteristic apex the backcross might be confused with that species. The elongated apex of the blade of the new hybrid, while like that of *A. ebenoides*, is much shorter in relation to the whole blade. (One visitor described the leaves of the backcross as being “like those of *platyneuron* except for a small *ebenoides* tip.”) The backcross has somewhat less of the dark-brown coloration on the midrib than does typical *A. platyneuron*. The leaves shown in *Plate V* were drawn from the lower view, to show the size of the dark-colored sector on the underside of the midrib. On the upper side, the dark color does not run so far either in the backcross or in *A. ebenoides*. The juvenile leaves of the new hybrid are quickly separable from the corresponding leaves of *A. ebenoides* by their deeper dissection, the crenate laminar margins, and the shorter petioles (*Figs. A₁–A₃ vs. Eb₁–Eb₃*).

As discussed above, the cytological behavior of a backcross in the Appalachian Aspleniums would be expected to be distinctive, showing certain characteristic features. Cytological examination of the backcross hybrids re-

ported for the first time here revealed that the somatic chromosomes numbered 108, i.e., that they are triploid. At the time of spore formation in young sori, the pairing behavior of the chromosomes during meiosis was approximately that predicted, namely 72 bodies (36 univalents and 36 bivalents). The actual figures obtained by averaging the estimates for 10 sporocytes from 5 plants were 70.5 (66–75) units, with 36.4 (33–41) univalents and 34.1 (30–38) bivalents. The backcross therefore possesses a radically unbalanced chromosome complement, and cannot be expected to exist in a fertile state.

At the time of this writing, the ten plants of the new hybrids are growing vigorously and producing numerous leaves which are harvested from time to time. A limited number of individual specimens of leaves will thus be available for distribution to interested persons upon request.

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Notes on Fern Distribution in Louisiana

JOHN A. MOORE

The additional information reported below concerning the distribution of some of the ferns in northern Louisiana has been gained by several years of botanizing. The localities are in addition to those in Brown and Correll.¹ The specimens cited are deposited in the herbarium of Louisiana Polytechnic Institute.

BOTRYCHUM VIRGINIANUM (L.) Swartz. The rattlesnake fern is evidently of wide distribution but rarely collected in Louisiana. I have it only from Lincoln Parish: 8 miles southwest of Ruston, S36 T17N R4W (*Moore* 5523); Redwine Farm, 5 miles southwest of

¹ Brown, Clair A. and D. S. Correll. *Ferns and Fern Allies of Louisiana*. Louisiana State University Press, 1942.

Ruston (*Moore* 6202).

BOTRYCHIUM DISSECTUM Spreng. var. *OBLIQUUM* (Muhl.) Clute. Fairly common late in the summer in wet years. Lincoln Parish: 2 miles northeast of Ruston (*Moore* 5353). Jackson Parish: 1 mile north of Vernon (*Moore* 6404). Ouachita Parish: Cheniere (*Moore* 6494).

LORINSERIA AREOLATA (L.) Presl. Abundant in boggy streams and springs. Lincoln Parish: Ruston (*Moore* 4043). Jackson Parish: 1 mile northwest of Clay (*Moore* 5388). Ouachita Parish: Camp Kiroli (*Moore & Chappell*).

ONOCLEA SENSIBILIS L. It was a surprise to find the Sensitive Fern on D'Arbonne Bayou, a tributary of the Ouachita River, more than 75 miles from any other reported station in Louisiana. It formed an extensive, vigorous colony, more than 100 yards long on the south bank of the bayou. This station is normally flooded in the spring. Abundant fruiting material was collected. Lincoln Parish: D'Arbonne Bayou, S26 T20N R2W (*Moore* 5323).

POLYPODIUM POLYPODIOIDES (L.) Watt. Our collections from Jackson, Lincoln, and Union Parishes fill in a distributional gap in northern Louisiana. Jackson Parish: 2 miles northwest of Clay (*Moore* 5386). Lincoln Parish: Ruston (*Moore*). Union Parish: 0.5 mile north of D'Arbonne Fire Tower (*Moore*).

WOODSIA OBTUSA (Spreng.) Torr. This fern was found growing abundantly in clumps in an open pasture. The locality represents a considerable range extension from the nearest stations given by Brown and Correll. Lincoln Parish: Calahan Farm, 8 miles southwest of Ruston, S36 T17N R4W (*Moore* 5519).

SELAGINELLA APODA (L.) Spring. Found abundantly in moist places both in spring and autumn. Jackson Parish: 1 mile south of Vernon Fire Tower (*Moore*

6521). Lincoln Parish: Ruston (*Moore*).

LOUISIANA POLYTECHNIC INSTITUTE.

Notes on Kansas Ferns

RONALD L. MCGREGOR AND EMILY L. HARTMAN

Field and herbarium studies made during the past year have provided additional data concerning plants little known in our flora, and information concerning some doubtful records has been revealed. Significant extensions of range are given below for a few taxa. The specimens cited in this paper are in the herbarium at the University of Kansas, unless otherwise indicated.

ISOËTES MELANOPODA Gay and Dur. Previous reports of this quillwort from Kansas have been based on a specimen collected by John C. Hancin in a low, moist area in a wheatfield, Saline County, May 20, 1943. Mr. Hancin searched repeatedly but unsuccessfully for additional specimens in succeeding years. The presence of this species in Kansas is now certain with the discovery in the summer of 1955 of a large colony on shallow soil, over limestone, in a small ravine, located in an open blue-stem prairie, 3 miles west of Neodesha, Wilson County (*McGregor & Hartman* 10267, 10861). A number of plants in the colony could be considered as *Isoëtes melanopoda* forma *pallida* (Engelm.) Fern.

ISOËTES BUTLERI Engelm. is included in lists of ferns known in Kansas on the basis of a specimen collected in Cherokee County by A. S. Hitchcock in 1892. Numerous attempts have been made by several collectors to relocate the site from which the specimen was taken, but all have failed. The species has not been found elsewhere in Kansas. Hitchcock's collection came from the small Ozarkian area in extreme southeastern Kansas.

BOTRYCHIUM DISSECTUM Spreng. is known from the

extreme southeastern corner of Kansas, and the forma *obliquum* (Muhl.) Fern. is found in the eastern one-eighth of the state, where it occurs as an occasional plant in rich woodlands.

OPHIOGLOSSUM ENGELMANNII Prantl is found abundantly in shallow soil over limestone in the bluestem prairies and open woodlands of the eastern one-fourth of the state. In such sites thousands of plants are often encountered. The literature reports it only from calcareous or argillaceous barrens; however, we have the species from a strictly sandy soil over sandstone in an open wooded area in which *Quercus stellata* Wang. is the characteristic plant. This collection (McGregor 4186) from central Chautauqua County extends the known range of the species some 50 miles westward in the state.

OPHIOGLOSSUM VULGATUM L. has been reported from Kansas on the basis of a specimen in the "herbarium at the University of Kansas," but no such specimen is present in the herbarium now, and, therefore, this species should thus be excluded from the list of Kansas ferns until further evidence is obtained.

OSMUNDA REGALIS L. is reported from Kansas on the basis of a specimen collected in Woodson County by W. H. Horr on July 10, 1930. The location was given as a wet creek bank just southwest of Yates Center. This site apparently is now in the middle of a city reservoir; and as the surrounding area has been searched repeatedly without finding further plants, it is doubtful if this species should be listed as a part of the state's present flora.

CYSTOPTERIS FRAGILIS (L.) Bernh. var. PROTRUSA Weatherby is a common fern of eastern Kansas woodlands. In late May or early June, the fronds of this fern are often infected with the ascomycete *Taphrina cystopteridis* Mix which causes the formation of small yellowish galls on the frond. By July, the fronds have browned,

dried, and died back for the season. In late September or early October, *Cystopteris fragilis* var. *tennesseensis* (Shaver) McGregor is in its prime and is infected by the above fungus in the same way. At this time, fall fronds of var. *protrusa* are abundant, but do not appear to be infected by the fungus.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott has previously been known only from the southeastern quarter of the state. A recent collection (McGregor 10058) extends the range some 50 miles north to Franklin County.

PELLAEA ATROPURPUREA (L.) Link is a common fern over the eastern half of the state, where it is found on limestone and sandstone outcrops. In August, 1955, specimens were taken from outcrops of gypsum in Barber and Comanche Counties. These collections (McGregor 10944, and 10977) extend the range some 130 miles to the west in the southern half of the state. The plants were numerous on shaded, dry gypsum outcrops and were relatively abundant on red, gypsiferous soil below the outcrops. In the last habitat the fern is associated with *Bouteloua gracilis*.

CHEILANTHES FEEI Moore is a rare fern in Kansas and known previously only on Dakota sandstone in three counties in north-central Kansas and from one doubtful record from sandstone in Woodson County, in southeastern Kansas. Recent field-work has revealed several extensive colonies on outcrops, called Mortar beds, which consist of cemented zones or beds of sand and gravel, in Hodgeman and Ford Counties. Specimens (McGregor 10928, and 10935) from these counties extend the range of the species some 140 miles southwestward in the state.

AZOLLA MEXICANA Presl has been found (McGregor 5198) in the central part of the state in an area known as the Cheyenne Bottoms, Barton County, some 200 miles west of the other known stations, which are in Douglas and Jefferson Counties, in northeastern Kansas.

A few species of ferns which appear in several lists of Kansas plants and which are the basis for the citation of the state in ranges should be removed from such records. These reports have been based on a series of sheets in the herbarium of the University of Kansas sent in by J. Wilson, of Leavenworth. Mr. Wilson was apparently the first individual in the state to cultivate ferns. From his cultivated plants he prepared herbarium specimens and sent them to the University, where they are deposited. Among these are *Athyrium filix-foemina*, *Dryopteris cristata*, *D. hexagonoptera*, *D. spinulosa*, *Polystichum acrostichoides*, *Asplenium platyneuron*, *Asplenium trichomanes*, and *Cystopteris fragilis*. All of these have the date 1871 or 1872 and have the abbreviation *cult.* on the label. However, on one sheet bearing a specimen of *Dryopteris goldiana* and on another with *Athyrium pycnocarpon*, the "cult." does not appear. Therefore, these sheets have been accepted as valid records, and the species included in the state's flora. It is clear that the Wilson series represents cultivated specimens only, as none of the native ferns of the Leavenworth area are included without the "cult." on the label. It also seems as though the labels were prepared by someone other than Wilson, for the same handwriting appears on other labels in the herbarium. It seems certain that the individual writing the labels merely omitted the "cult." inadvertently on the above two, and thus introduced errors in our records.

A similar situation applies to the report of *Athyrium filix-foemina* from Osage County. A specimen in the herbarium of Kansas State College, Manhattan, Kansas, is the basis for its inclusion in our flora. Available evidence indicates the plant actually came from a garden. There is no habitat in Osage County suitable for this fern, and only a few of the most common ferns are to be found there.

UNIVERSITY OF KANSAS, LAWRENCE, KANSAS.

The Family Names of the Lycosphens

CLYDE F. REED

Modern classifications of the ferns and lycosphens ("fern-allies") group them into various Classes, all of which along with the Gymnospermae and Angiospermae are called the Tracheophyta ("vascular plants"), in allusion to the development of a vascular system, in distinction to the Bryophyta and other lower, non-vascular groups. There are four classes of Tracheophyta now recognized. The Psilopsida include *Psilotum* and *Tmesipteris*; the Lycopsidea, *Lycopodium*, *Selaginella*, and *Isoëtes*; the Sphenopsida, *Equisetum*; and the Pteropsida, the Filicineae (ferns), Gymnospermae, and Angiospermae. The first three, along with the Filicineae, were formerly grouped as Pteridophyta in older classifications.

In earlier years the forms for names above the rank of genus were not definitely prescribed, and the same name was often used to represent an order, a family, or a tribe, without change in the termination.¹ The present International Code of Botanical Nomenclature (1952) specifies the terminations to be used: Divisions to end in *-phyta*, Subdivisions in *-phytina*, Classes in *-opsida*, Subclasses in *-idae*, Orders in *-ales*, Suborders in *-ineae*, Families in *-aceae*, Subfamilies in *-oideae*, Tribes in *-eae*, and Subtribes in *-inae*. A good many older names were published with terminations other than those indicated above; the Note appended to Article 29 of the Code is intended to allow the endings to be changed to accord with the rule, without changing the authority [or date, for purposes of priority].

Because of the absence of any sort of index to the ordinal and family names of the lycosphens, there has been a good deal of disagreement concerning the proper

¹ In many editions of Engler & Gilg, Syll. der Pflanzenfam., the ending *-ales* is used for Class, Subclass, and Order ("Reihe").

authorities. In most works, no authorities at all have been given. Those adopted below seem to be the ones having priority, but it is possible that some of these may be displaced by future studies.

Order LYCOPODIALES Trevisan, Bull. Soc. Ital. Sci. Nat. **19**: 476. 1876; Engler, Syll. Vorles. 58. 1892.

Family LYCOPODIACEAE L. C. Richard ex Lam. & DC., Fl. Franc. **2**: 571. 1805 (p.p. excl. *Isoëtes*); Grenier & Godron, Fl. France **3**: 653. 1855–56; Mett. Fil. Hort. Lips. 16. 1856; Warming, Haandb. Syst. Bot. 111. 1879; Luerssen, Die Farnpflanzen, in Rabenh. Krypt. Fl. **3**: 782. 1889; Britton & Brown, Fl. North. States & Can. **1**: 39. 1896; ed. 2, **1**: 42. 1913; Fiori, Fl. Ital. Crypt. pt. 5 (Pteridophyta) 386. 1943.

Order SELAGINELLALES Wettstein, Handb. Syst. Bot. **2**: 97. 1903.

Family SELAGINELLACEAE Reichb., Handb. Nat. Pflanzensyst. 163. 1837 (as Selaginelleae); Mett., Fil. Hort. Bot. Lips. 16. 1856 (as Selaginelleae); Kanitz, A term. növ. attek. 9. 1874; Warming, Haandb. Syst. Bot. 111. 1879; Underwood, Our Nat. Ferns, ed. 1, 50, 103. 1881; Luerssen, Die Farnpflanzen, in Rabenh. Krypt. Fl. **3**: 862. 1889; Britton & Brown, Fl. North. States & Can. **1**: 44. 1896.

Order ISOËTALES Gola, in Gola, Negri, & Cappelletti, Tratt. di Bot. ed. 1, **1**: 697. 1935;² Koidzumi, Acta Phytotax. et Geobot. **7**: 11. 1938; Reed, Index Isoëtales, Bol. Soc. Broter. **27**: (Ser. 2a): 5–72. 1953.

Family ISOËTACEAE Reichb. Consp. Reg. Veg. 43. 1828 (as Isoëteae); Dumortier, Anal. Fam. Pl. 68. 1829; Bartling, Ord. Nat. Pl. 16. 1830 (as Isoëtae); Endl., Gen. Pl. 68, 69. 1838–40; Ledeb., Fl. Ross. **4**: 495. 1853; Trevisan, Bull. Soc. Ital. Sci. Nat. **19**: 475. 1876; Underwood,

² In G. N. Jones and G. D. Fuller, Vascular Plants of Illinois 10, 1955, the authority is given as "Schaffner, Field Man. Fl. Ohio 21. 1928," but the name is a *nomen nudum* at this place.

Our Nat. Ferns, ed. 1, 104. 1881; Britton & Brown, Fl. North. States & Can. 1: 45. 1896; Reed, Index Isoëtales, l.c. 13. 1953

Order EQUISETALES Trevisan, Bull. Soc. Ital. Sci. Nat. 19: 476. 1876.

Family EQUISETACEAE L. C. Richard ex Lam. & DC. Fl. Franc. 2: 580. 1805; Underwood, Our Native Ferns, ed. 1, 50, 103. 1881; Luerssen, Die Farnpflanzen, in Rabenh. Krypt. Fl. 3: 622. 1889; Britton & Brown, Fl. North. States & Can. 1: 35. 1896; Fiori, Fl. Ital. Crypt. pt. 5 (Pteridophyta), 332. 1943.

10105 HARFORD ROAD, BALTIMORE, MD.

A New Locality for *Marsilea quadrifolia* L.

BERT MILLER

In September 1951, the writer was botanizing in Hal-dimand County, Ontario, along Nanticoke Creek, which flows into Lake Erie about six miles east of Port Dover. Just south of the village of Nanticoke he was surprised to find floating on the surface of the sluggish stream, leaves that looked like four-leaved clovers. Closer examination showed that they were attached to petioles about 18 inches long embedded in the muddy bottom of the stream, and examination of the bases of the petioles showed a number of sporocarps. The plants proved to be *Marsilea quadrifolia* L., an introduced species, a rare find indeed, for this plant has been found only once before in Ontario: A specimen collected in 1911 at Toronto by T. J. Ivy (Herbarium of the University of Toronto). It has not been found in the Toronto area since.

The plants at the new locality covered an area of about half an acre of water, and were so dense that one could hardly wade through them. It is evident that they have been there for some years. A number of the vil-

lagers were questioned concerning the possible origin of the plant, but none was able to give a satisfactory explanation of its occurrence. Specimens from the same place have been collected each year since 1951, and the plants seem to be becoming even more abundant.

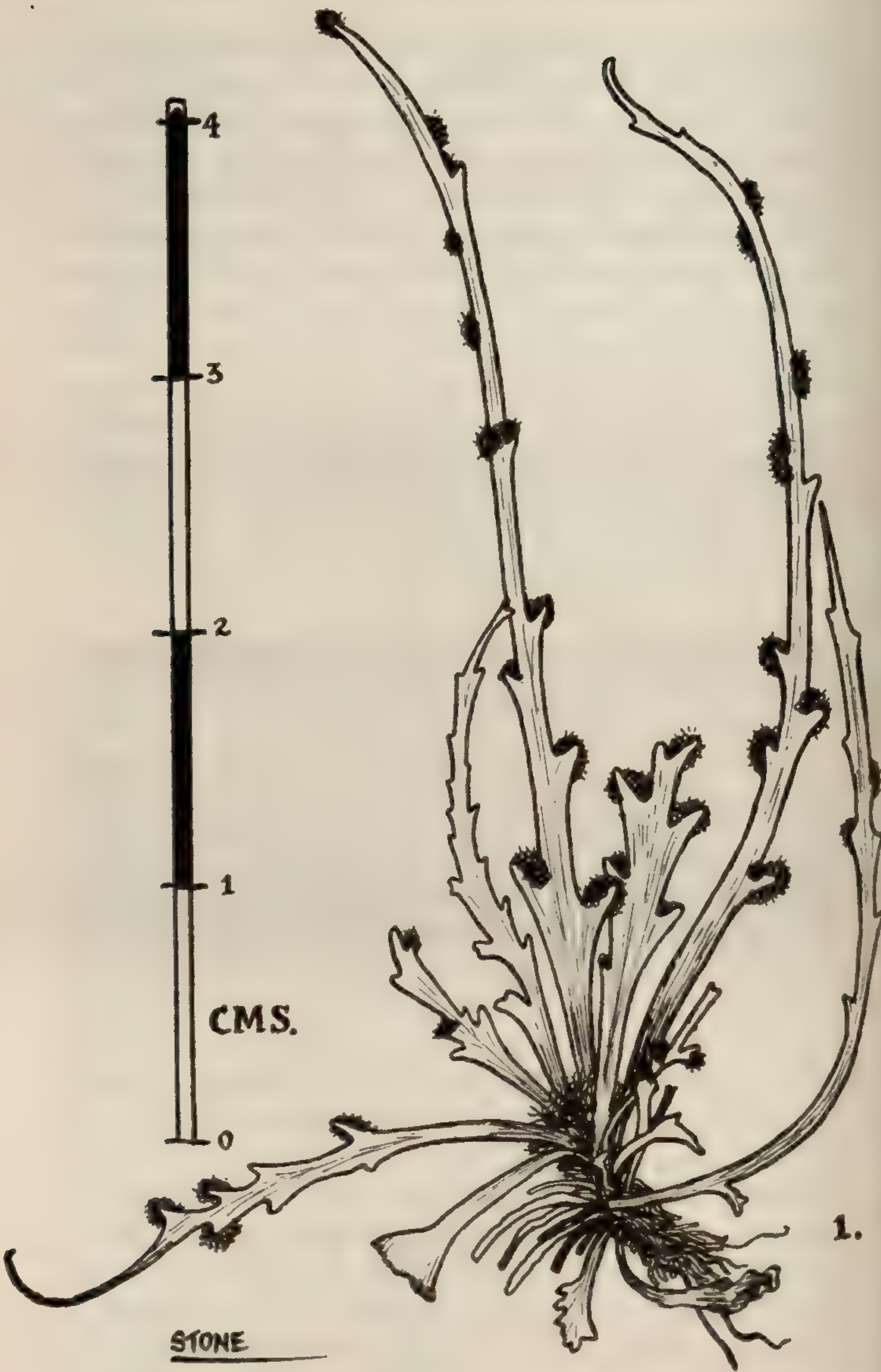
M. quadrifolia was first reported in North America at Bantam Lake, Litchfield, Connecticut, in the addendum to the fourth edition of Gray's Manual, 1863. It has since been recorded at a number of localities in Maine, Massachusetts, Indiana, Connecticut, and in the vicinity of Ithaca, New York. It is still very local in America, and does not appear to be becoming a pest of waterways like the introduced Flowering Rush, *Butomus umbellatus*, or the Water Hyacinth, *Eichornia crassipes*.

FORT ERIE, ONTARIO

An Unusual Form of *Asplenium pinnatifidum*

ROBERT H. MOHLENBROCK

While studying a population of *Asplenium pinnatifidum* Nutt. in southern Illinois during January, 1955, a unique form of this species was discovered. Three specimens were observed that differed from normal material in that their laminal development was so completely suppressed that the entire aerial portion of the plant appeared to be composed only of fruiting rachises (Figure 1). The longest frond of the three plants measured 4.8 cm., the shortest 0.4 cm. The rachises had laminal protuberances arranged alternately along them. On the abaxial surface of almost all these projections was borne a sorus. The sori varied in size, but averaged two millimeters in diameter. They were so large that most of them could be observed from the adaxial side. Sometimes they were placed back to back (subdiplazioid), a condition which gives the indusium the appearance of being double. The specimens were fruiting prolifically,



FORM OF ASPLENIUM PINNATIFIDUM

with rachises as short as 0.6 cm. bearing sori.

The variability of leaf forms in *Asplenium pinnatifidum* has been noted by Copeland¹ and Wagner,² the latter stating that "the blades show conspicuous irregularity in pattern." However, as far as is known to the author, the reduction of the frond to a skeletonized lamina bearing sori has been reported for only one other fern—*Phyllitis Scolopendrium* (L.) Newm. (*Scolopendrium vulgare* Sm.).³ It is of interest that the genus *Phyllitis* is usually placed near *Asplenium*. In fact, Copeland⁴ merges *Phyllitis* with *Asplenium* because of the great similarity in sori. Concerning *Phyllitis Scolopendrium*, Andersson-Kottö stated that "the most extreme reduction of growth proceeds so far as to leave scarcely more than a branched rhachis with sori along the edges." She found this to be due to a simple Mendelian factor in which the tendency for laminal reduction is recessive.

A specimen is on deposit in the herbarium of the Missouri Botanical Garden, the collection data being as follows: Growing among "typical" *Asplenium pinnatifidum* in crevices of sandstone bluffs, Giant City State Park, Union County, Illinois, January 16, 1955, *Mohlenbrock* 4950. Subsequent collections from the same area have shown several similarly reduced specimens.

The author is indebted to Mr. Benjamin C. Stone who contributed the illustration.⁵

DEPT. OF BOTANY, WASHINGTON UNIVERSITY, ST. LOUIS.

¹ Copeland, E. B. Two Fern Monstrosities. *Botanical Gazette*, 34: 143, 144. 1902.

² Wagner, W. H., Jr. Reticulate Evolution in Appalachian *Aspleniums*. *Evolution*, 8: 103–118. 1954.

³ Andersson-Kottö, Irma. A Genetical Investigation in *Scolopendrium vulgare*. *Hereditas* XII. 1929.

⁴ Copeland, E. B. *Genera Filicum*. 1947.

⁵ A similar type of leaf reduction is described in English literature in some other genera, e.g. *Dryopteris* and *Athyrium*. R. C. B.

A Collection of *Asplenium montanum* in Indiana

DALE M. SMITH

Deam¹ listed four species of *Asplenium* for Indiana, as well as one species of the closely related genus *Camptosorus* and the intergeneric hybrid *Asplenosorus ebenoides* (Scott) Wherry. All except *Asplenium platyneuron* (L.) Oakes, and *Camptosorus rhizophyllus* (L.) Link are extremely local and are considered rare species by Deam.

In the spring of 1955 it was my good fortune to find a fifth species of *Asplenium* of the Indiana flora—*A. montanum* Willd. It too, must be considered a rare species, as only one isolated colony of a few plants is presently known to exist in the state. The first collection from this spot (sandstone cliffs along Raccoon Creek, near Freeman, Owen County, Indiana) was made by the author in 1950 (Smith #203), but was not recognized as *A. montanum* until a 1955 collection was determined by Dr. Warren H. Wagner of the University of Michigan. The two collections were compared by Dr. C. B. Heiser of Indiana University and were considered conspecific.

This record of *Asplenium montanum* will be of interest to fern students for several reasons, but primarily because it lends support to Wagner's theory² concerning the hybrid origin of *A. pinnatifidum* Nutt. According to Wagner, *A. pinnatifidum* is an amphidiploid hybrid of *A. montanum* and *Camptosorus rhizophyllus*. However, until this collection was made, only one parent could be found in association with the hybrid in Indiana—that being *Camptosorus*. Even though *Asplenium*

¹ Deam, C. C. *Flora of Indiana*. 1940.

² Wagner, Warren H., Jr. *Reticulate Evolution in the Appalachian Aspleniums*. *Evolution* 8: 103–118. 1954.

montanum and *A. pinnatifidum* are not now in close association, the distance between them can be reckoned in terms of a few miles rather than hundreds.

The new locality is one of the marginal points in the distribution of the species.³ The region is very close to the Pennsylvanian-Mississippian unconformity in Indiana, and, consequently, limestone and sandstone are exposed in close proximity. Therefore, as one would expect, *Asplenium montanum* and *Camptosorus rhizophyllus* are found in close association. The relict nature of this bluff area in southern Indiana is evidenced by the presence in rather large numbers of hemlock trees, *Tsuga canadensis* (L.) Carr. Similar bluff areas with hemlock are known in Indiana, and in each case support a peculiar flora.

UNIVERSITY OF KENTUCKY, LEXINGTON, KENTUCKY

American Fern Society

The Florida Homemaker and Gardener for October 1955 carries a two-page, illustrated article entitled Staghorn Ferns. The account reports the extensive collection of Alvin B. Cutler, Miami nurseryman and Fern Society member, which contains 17 different species. The Staghorn-fern genus, *Platycerium*, with its array of bizarre and striking forms, is probably the most highly prized of tropical ferns from the horticultural viewpoint. It is reported to be easily grown in southern Florida under a variety of outdoor conditions.

The same issue carries also a story about another Fern Society member, Mrs. W. D. Diddell, of Jacksonville. It reports Mrs. Diddell's twenty-year study of Florida ferns, with an "inch-by-inch" search of the whole state, and her interest in two projects—the preparation of a

³ Wagner (in lit.) regards it as the northwesternmost collection of the species.

complete fern flora of Florida, and a monograph on the Staghorn-fern genus.—R. C. BENEDICT.

DRYOPTERIS VIRIDESCENS WANTED: Dr. Stanley Walker, The University of Liverpool, England, is interested in obtaining material of the Asiatic species *Dryopteris viridescens* in connection with his study of the cytogenetics of *Dryopteris* species. This species used to be available in greenhouse collections in New York. Living plants or spores are desired. Dr. Walker has recently published a first paper on the “*Dryopteris spinulosa* complex—I,” dealing with British and European material (*Watsonia*, vol. 3, September, 1955). A study of American forms of this group is well under way.—R. C. BENEDICT.

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EDITORS

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R. C. BENEDICT

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American Fern Journal

VOL. 46

JULY-SEPTEMBER, 1956

No. 3

The Microscopic Structure of the Mature Spores of the Sensitive Fern, the Ostrich Fern, and the Royal Fern¹

NORMAN P. MARENGO

In view of some anticipated experimental work dealing with irradiation of fern spores, a number of species were examined to determine which spores would be most suitable for use with various cytological techniques following irradiation. This paper represents the results of some preliminary work with *Onoclea sensibilis*, *Matteuccia pensylvanica*, and *Osmunda regalis*.

The work of Knudson (1940) with *Polypodium aureum* indicated that radiation may produce heritable plastid changes. With this species, however, the physical and optical nature of the spore-coat make it unsuitable for either direct microscopy or sectioning. Immediate post-irradiation morphological changes were not detected, and plastid abnormalities were observed only after germination (M. Marengo 1941).

The spores of the ostrich fern and sensitive fern have been found to be generally suitable for direct microscopy. All three species mentioned are satisfactory, in varying degrees, for cytological fixation, sectioning, and staining techniques. An account of the techniques used and the results secured with the mature spores are herewith described.

¹ A paper prepared for the Fern Spore Symposium, Mistaire Laboratories, Milburn, New Jersey, June 4, 1955.

[Volume 46, No. 2, of the JOURNAL, pp. 65-96, was issued July 11, 1956.]

MATERIALS AND METHODS

Mature spores were collected and concentrated as follows. Spore-bearing fronds or frond parts were broken up and the fragments spread on paper. If the paper is tilted slightly, and gently tapped or agitated, leaf and sporangia fragments will separate out, leaving behind the shed spores and unopened sporangia. If the sporangia are then wet, and allowed to dry, they open and can be readily separated from the released spores by again tilting and agitating the paper. Pure masses of spores can thus be secured with little difficulty, and sectioning troubles caused by the tough annulus tissue may in this way be avoided.

For immersion in the fixative, large numbers of spores were placed in small bags made of pre-soaked animal intestine membrane. These bags were tied with fine thread, manipulated to remove air bubbles, and placed in the fixing fluids. These membrane bags were permeable to all reagents used in the techniques, and from fixation on, each mass of spores could be handled as a single piece of tissue. Puncturing the bag in several places was found to speed up the penetration of the reagents.

For nuclear preservation, Flemming's strong fluid was the fixative used (Baker 1945). For preservation of cytoplasmic structures, the procedures of Lewitsky (1925) and Huseby (1946) were employed.

Following fixation and washing, spores were dehydrated in ethyl alcohol, cleared in xylene, and embedded in a paraffin medium consisting of 90% 56–58° paraffin, 5% beeswax, and 5% bayberry wax. Slides of sections 3–4 μ in thickness were mordanted 24 hours in 2% ferric alum, rinsed in distilled water, and stained 24 hours in 0.5% hematoxylin, following which they were destained in 2% ferric alum. Following washing, the slides were dehydrated in ethyl alcohol, cleared in

xylene, and mounted in gum damar.

OBSERVATIONS

Onoclea sensibilis. The spores of this species are most difficult to section. They are penetrated only by the strongest fixatives, and the only suitable preparations are of material fixed for 48 hours in Flemming's strong fluid. Several minutes in full-strength "Clorox" will remove the outer spore coat, but apparently will not kill the spore. The difficulty in sectioning these spores is due entirely to the tough and brittle nature of the inner spore coat. Of hundreds of sections made, only a few spores were sectioned as well as the one in *fig. 1*. After sectioning a mass of *O. sensibilis* spores, the knife must immediately be sharpened. The sound produced when a block is sectioned suggests the cutting of a piece of sandpaper.

The chemical nature of this thick inner spore coat requires further study. If these spores are soaked overnight in concentrated H_2SO_4 the outer spore-coat and protoplast are dissolved, but the troublesome inner coat is still recognizable. This result suggests silica, and this is supported by the appearance of consistent quartz lines with X-ray diffraction following micro-incineration. Some physical tension in this wall is suggested by the curling out of its broken fragments in sectioned material (*fig. 1*).

Sections of these spores, fixed in Flemming's fluid, consistently show a centrally placed nucleus with a well-defined nuclear membrane, faintly staining chromatin, and a large nucleolus. The chloroplasts are densely crowded around the nucleus, and the periphery of the spore is a mass of deeply staining granules, which in the living condition appear colorless. The chemical and cytological nature of these peripheral granules is yet to be established, but it is probable that they are either immature plastids or granules of ergastic mate-

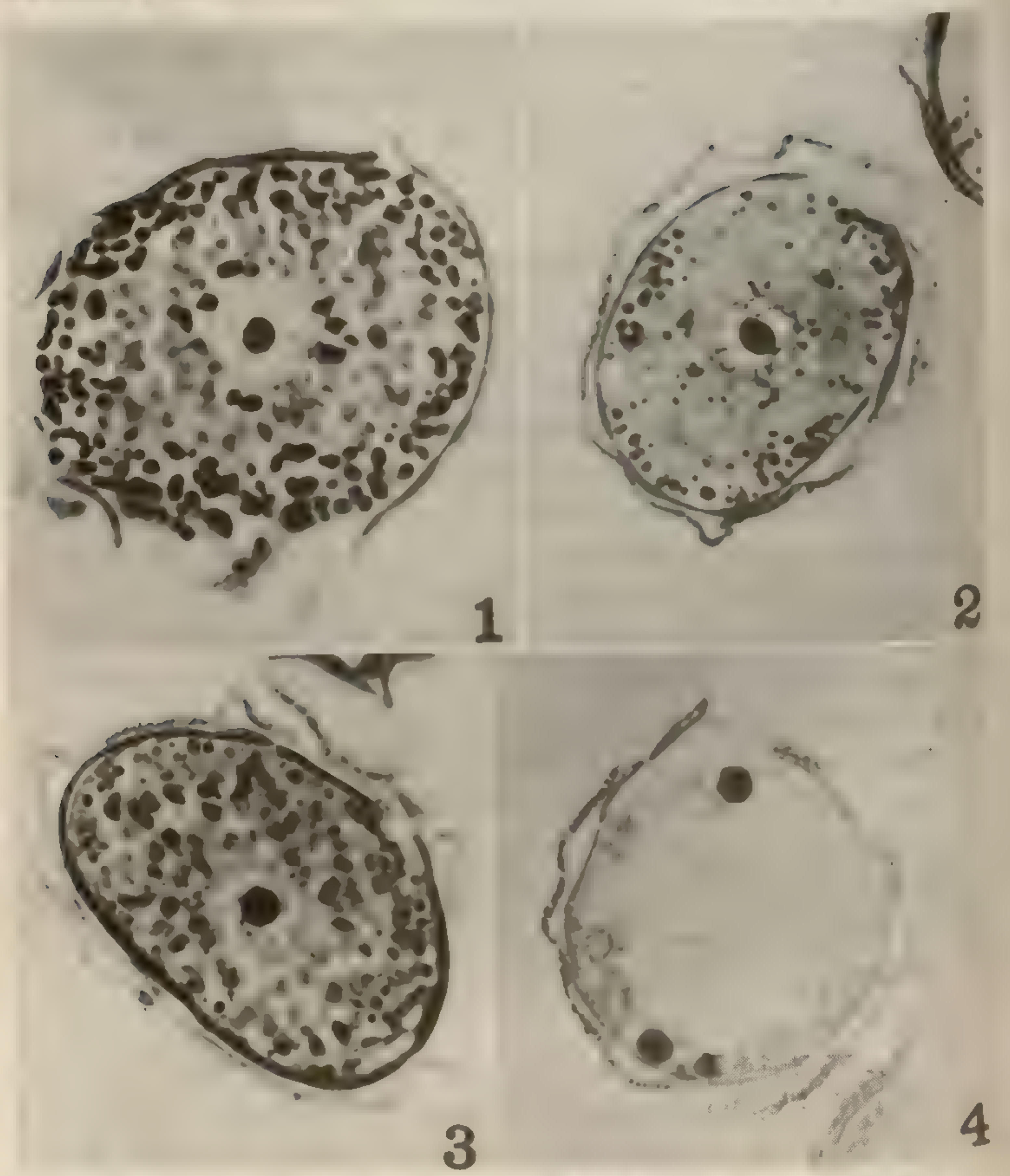


Fig. 1. *Onoclea sensibilis*; FIXATION FOR 48 HOURS IN FLEMMING'S FIXATION; $\times$ ca. 860. Figs. 2-4. *Matteuccia pensylvanica*. Fig. 2. FLEMMING'S FIXATION, $\times$ ca. 860. Fig. 3. LEWITSKY FIXATION, $\times$ ca. 860. Fig. 4. FLEMMING'S FIXATION, $\times$ ca. 860. Figs. 1-3 SECTIONED AT 4 μ AND STAINED WITH IRON HEMATOXYLIN, fig. 4, UNSTAINED.

rial. A clearly positive starch or protein reaction has not been obtained.

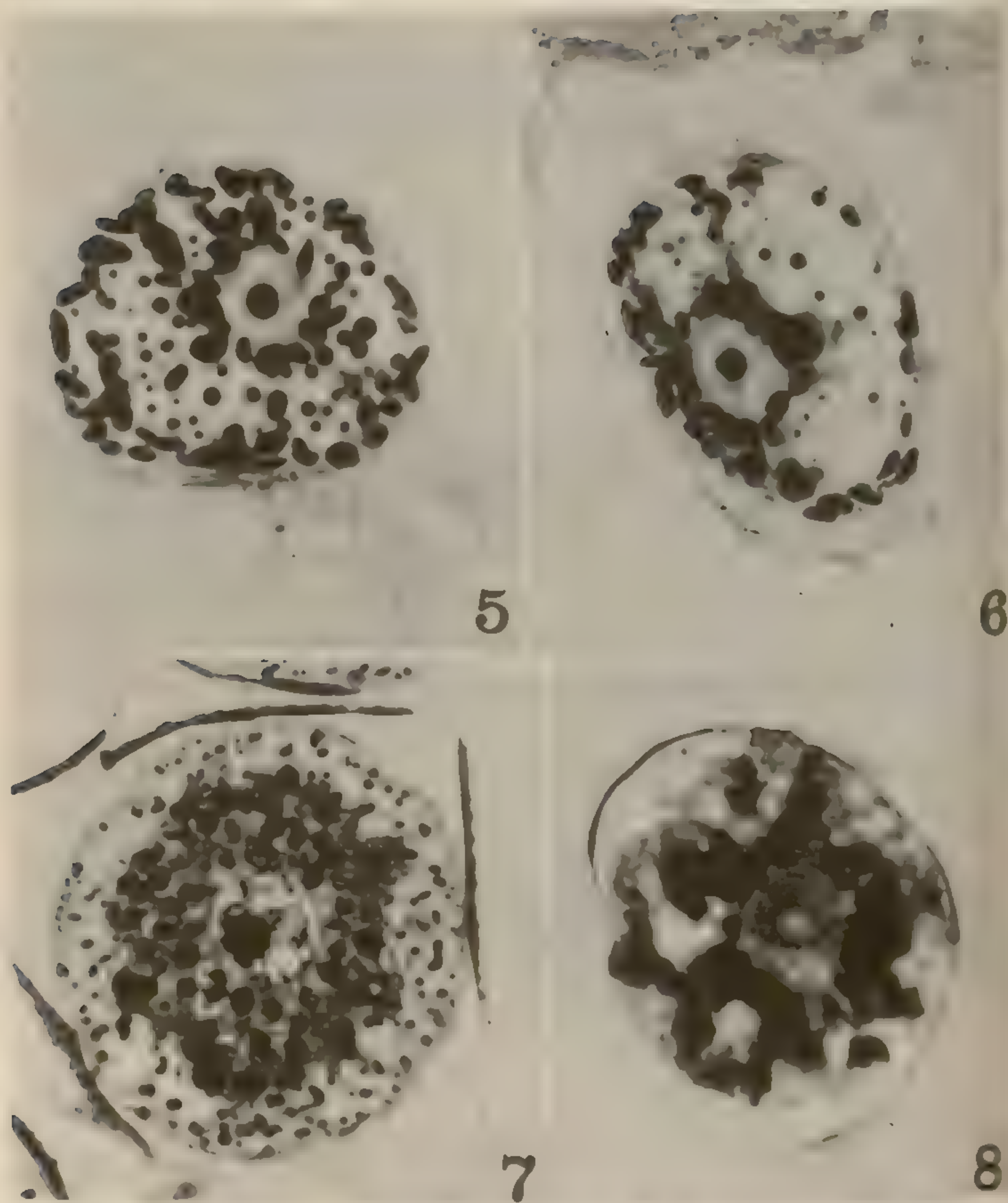
Although *O. sensibilis* spores can readily be looked into following exospore removal, sectioning difficulties render them unsuitable objects for further cytological investigation.

Matteuccia pensylvanica. The spores of this species are slightly smaller, but practically identical in appearance to those of *O. sensibilis*. The exospore is easily removed, and the spore contents readily accessible to direct microscopy. The inner spore coat, although as thick as in *O. sensibilis*, presents no problem in microtomy. Fixation with Flemming's fluid and by the Lewitsky method yielded highly satisfactory material. Spores of this species can be easily sectioned at 3–4 μ , and due to rapid and complete penetration of fixatives, staining is brilliant and of uniform quality.

As in *O. sensibilis*, the nucleus occupies a central position, and has a deeply staining nucleolus, which is well preserved following Flemming and Lewitsky fixations (*fig. 2, 3*). Following Flemming fixation, the nucleus shows a sharply staining network of beaded strands, which in Lewitsky material show only as faintly staining granules (*fig. 2, 3*).

The chloroplasts in the mature spore are concentrated around the nucleus and the periphery of the spore contains numerous granules which stain very deeply following both fixatives, and which are colorless in the living spore. Clear vacuoles may appear at the edge of spore sections in some cases, and in unbleached and unstained Flemming slides, are shown to be large fat droplets (*fig. 4*). The chloroplasts stain deeply following Lewitsky fixation, and only faintly following Flemming's fluid (*fig. 2, 3*).

In favorable sections, a rough outer and a smooth inner spore-coat are visible, as well as a sharp surface



Figs. 5, 6. *Matteuccia pensylvanica*. Fig. 5. LEWITSKY FIXATION 5 DAYS AFTER SOWING, $\times$ ca. 860. Fig. 6. LEWITSKY FIXATION 7 DAYS AFTER SOWING $\times$ ca. 860. Figs. 7, 8. *Osmunda regalis*. Fig. 7. FLEMMING'S FIXATION $\times$ ca. 1000. Fig. 8. HUSER'S FIXATION, $\times$ ca. 1000. ALL SPORES SECTIONED AT 4μ AND STAINED WITH IRON HEMATOXYLIN.

limiting the protoplast proper (*fig. 3*). In spores sown on agar, but not yet germinated, the surface of the protoplast shows an additional thick membrane, which is presumed to be the cell wall of the germinating protoplast (*fig. 5*).

Sections of spores fixed by the Lewitsky method 5–7 days after sowing showed marked changes in structure and staining reactions. The chloroplasts now stain an intense blue-black with hematoxylin, and have migrated to all parts of the spore. During this pre-germination stage, the nucleus moves from its central position, and large vacuoles appear in the cytoplasm (*fig. 5, 6*). The complete history of nuclear and cytoplasmic changes leading up to germination is not available at present, but a further study of this is contemplated when this season's spores are available.

Osmunda regalis. The mature spores of this species are green and almost uniformly spherical. The outer spore-coat is thick and rough and not readily removed; it usually breaks in sectioning, but without damage to the protoplast (*fig. 7*). A very thin inner spore-coat is distinguishable from the limiting surface of the protoplast, but this is easily sectioned without damage to the spore (*fig. 7*).

The nucleus occupies the center of the spore and, following Flemming's fixation, shows the characteristic interphase appearance, with dark nucleolus and sharply staining chromatic network (*fig. 7*). The chloroplasts, as in the other two species, are crowded around the nucleus, and the peripheral cytoplasm contains numerous deeply staining granules and many vacuoles are evident (*fig. 7*).

Huseby's formalin-pyrogallol, which has proved highly satisfactory for meristematic and sporogenous tissues, has not been found of value with these spores. The entire spore is poorly fixed and sectioning without

damage is impossible. Chloroplasts are clumped in a dark mass around the nucleus, and the peripheral granules fail to stain (*fig. 8*). Lewitsky-fixed spores of this species were not available for this report.

DISCUSSION

Because of their large size and relative ease of sectioning, the spores of *Matteuccia pensylvanica* and *Osunda regalis* are highly favorable objects for descriptive and experimental procedures. In this regard, future work along the following lines is planned.

1. Irradiation of spores with study of immediate post-irradiation effects on nucleus and cytoplasm.

2. Germination studies of normal and irradiated spores with emphasis on cytological changes in the pre-germination stages.

3. Utilization of microchemical tests to establish the precise identity of the peripheral granules in all three species.

Onoclea sensibilis has very large spores, but with impossibly tough walls. Preliminary work suggests silica as the source of the trouble. This should be confirmed by more extensive tests.

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Ferns in Baskets¹

DOUGLAS SWINSCOW

Most of the ferns that grow on rocks on walls are rather difficult to establish in flowerpots. The outstanding exception is *Asplenium marinum*. In a greenhouse from which frost is excluded it will grow in a pot to a far greater size than among the coastal rock clefts that are its usual habitat in Britain. But the other Spleenworts seem rather to resent being planted in pots, and a botanist recently mentioned to me that in his laboratory they find *Asplenium viride* impossible to keep in a healthy state. As I have had some success in growing these ferns in wire baskets, I thought a note on the method might be of interest not only to those members of the Society who, like me, grow them for pleasure in their greenhouses, but also to botanists and others who require a constant supply for scientific study.

The wire baskets that I buy are of the usual horticultural pattern and the cheapest I can find. The best variety consist mainly of a thick wire wound spirally into the shape of a bowl, with three wires leading from the top edge to meet at a wire hook, from which the whole is suspended. When bought, the baskets are too large for my purpose, so I cut them down with wire clippers to about half size. I then line them with moss, my favourite being the common woodland moss *Mnium hornum*. It can be sliced off the woodland floor with thin sheets of the soil in which it grows. The advantage of taking this moss in slices of soil is that it will continue to grow and remain fresh throughout the year. The compost in which I put the ferns is made up of about equal parts of loam, sterile peat (or sometimes leaf-

¹ Reprinted from the British Fern Gazette, vol. 8, no. 6, pp. 141, 142. 1955.

mould), and sand. For lime-loving ferns I add some limestone chips; or the fern may be planted between small nuggets of limestone knocked off a rock of it.

In order to water these baskets I have constructed an exceedingly simple framework over the water-tank in my greenhouse (I am no handyman). It is a broad shelf on legs, supported about 2 feet above the top of the tank. Ferns in pots stand on it, and some hooks are screwed into its under-surface. I dip the baskets in the tank, and then hang them on the hooks to drain into it for a few hours, perhaps overnight. Rainwater, a precious commodity in Hertfordshire, is thus conserved.

The ferns I grow in this way are *Asplenium septentrionale*, *A. viride*, *A. trichomanes* in three varieties, *A. obovatum*, *Ceterach officinarum*, *Cystopteris dickieana*, and *Polypodium vulgare* in four varieties. That they grow with exuberance several members of the Society can testify, having seen them at the last annual meeting. That they grow better in baskets than in pots I have learnt by trial, since several of them spent a year or two in pots, where they languished, before being put into baskets, where they raced ahead. I have also been able to compare the results of growing two equal parts of the same clump of *Cystopteris dickieana*, one in a pot and the other in a basket. The vigour of the basket-grown plant greatly outshines that of the pot-grown. The same result was noted in two plants of *Asplenium viride*, one kept in a pot, the other transferred to a basket. The latter's fronds are about 6 inches long. Indeed so striking is the growth of the basket-grown plants that they seem on the average to be about twice the size of their pot-grown relatives, though as a result of giving various plants away, or of transferring all of some species to baskets, I have not sufficient material with which to compare actual measurements.

Ophioglossum tenerum in Georgia

GILBERT R. ROSSIGNOL

On Thanksgiving Day, November 24, 1955, accompanied by R. C. Marves and F. N. Irving, I discovered a sizeable colony of *Ophioglossum tenerum* Mett. and collected a number of specimens, some of which were deposited in the U. S. National Museum, and others were sent to the Department of Botany, University of Georgia. The locality is about one mile south of Savannah, Chatham County, near where U. S. Highway 17 crosses the Atlantic Coast Line Railway. Here a shallow excavation was made for material used in building an abutment for the construction of a bridge. The area of the entire depression is approximately $6\frac{1}{2}$ acres. In the center is a large pond which floods most of the lower ground during heavy rains and becomes completely dry in midsummer.

The overall height of the taller fertile spikes, all dehiscid, averages 14 cm.; the sterile blades, of which there are two to six per plant, are mostly 3 cm. long and 1.3 cm. wide. Many of the plants bear one or two new sporophylls from one to five cm. in height. The plants are growing in moist sandy soil in the light shade of tall grasses with little or no other vegetation.

This is the first authentic record of this species for Georgia. The only other record, reported in Ferns of Georgia by McVaugh and Pyron, is: "A doubtful specimen, which was presumably collected near Ebenezer, Effingham County, in the early part of the last century."

Lycopodium adpressum Chapm. was also discovered growing quite abundantly along the margins of the pond. Many plants with fertile branches were found. This was the first recorded for Chatham County, Georgia, by Dr. Duncan in 1955.

Nardoo

JOHN W. THIERET

The indigenous plants of Australia produce, for the most part, nothing laudable in the way of human food. The products of many of these, though "eatable," are not "fit to eat," to quote from J. D. Hooker's *Flora of Tasmania* (1860). An interesting example of such a plant is found in the clover fern or nardoo, *Marsilea Drummondii*, which occurs in swampy lands over much of the island continent. The hard sporocarps of the nardoo were—and, in remote districts, probably still are—utilized by the aborigines as an article of food. When the swamps dry up, the *Marsilea* leaves wither but the sporocarps remain. These the omnivorous natives collected, either by sweeping them with twig brooms into wooden vessels or by gathering the dried roots with sporocarps attached. In preparation for use, the sporocarps were pounded into a flour or meal between two stones. The flour was mixed with water, kneaded to a dough, and baked in ashes. Nardoo flour contains but scant nutritive matter, including a little starch and a mucilage, and cakes made from it are highly indigestible. The spore cases of the nardoo are the food to which the unfortunate explorers, Burke and Wills, resorted in a futile effort to sustain life at Cooper's Creek, Victoria, in 1861. In Will's journal we are told: "I cannot understand this nardoo at all; it certainly will not agree with me in any form. We are now reduced to it alone, and we manage to get from four to five pounds per day between us. . . . It seems to give us no nutriment. . . . Starvation on nardoo is by no means very unpleasant, but for the weakness one feels, and the utter inability to move oneself, for, as far as appetite is concerned, it gives me the greatest satisfaction." It has been suggested that the nardoo of Burke and Wills may have been

the seeds of *Sesbania aculeata*, a legume, rather than the sporocarps of a *Marsilea*, because of doubts that the latter can be obtained in sufficient quantity for food. However, reliable observers have reported that in certain areas 10 pounds of sporocarps might easily be gathered by one person in a day.

CHICAGO NATURAL HISTORY MUSEUM.

Notes on the Pteridophytes of Delaware County, New York¹

KARL L. BROOKS

Delaware County comprises an area of some 1,470 square miles (over 250 square miles larger than Rhode Island) in the southeastern part of New York State, occupied in large part by the western Catskills and their foothills. From a geographic point of view the entire county lies in the Catskill Mountain region—with the exception of the Susquehanna valley, bordering the northwestern side, which may be said to lie in the glaciated Allegheny Plateau. The higher mountain areas lie generally in the southeastern part of the county. Both branches of the Delaware River have their origin in the county. From a botanical point of view the flora is largely that of the beech-birch-maple forest regions, with the exception of the lower reaches of the Delaware River below Walton and Downsville, where oak-hickory intrudes.

The earliest records of Delaware County flora are contained in the *Fifty-fourth Annual Report of the Regents*

¹ This article is based largely on records filed in the herbarium of the New York State Museum, supplemented by observations and collections in the field. The author is deeply indebted to Stanley J. Smith, senior curator of the herbarium at the New York State Museum, who not only examined and verified the some 270 specimens of pteridophytes collected from Delaware County and presently located in herbaria at Albany, Cornell, and New York, but also gave the author access to records of the State Museum.

of the University of the State of New York (1841), where M. Platt, teacher of natural science at the Delaware Literary Institute, Franklin, listed some 380 "plants collected and examined, by the botanic class . . . during the summer term of 1840." A note at the end of the list states that "the preceding plants were collected by the botanic class, during a term of eleven weeks, and by some of the class preserved and arranged in herbariums according to the natural system. The most approved names of modern botanists have been adopted."

Platt, of course, was not writing a flora of the county; he was not even attempting to compile a catalogue of local plants. His list was merely intended to give some indication of the scope of the Institute's course in botany, which, even judged by modern standards, must have been quite comprehensive. It can be assumed that most of the plants "collected and examined by the botanic class" came from the local area; but a few of those listed have not since been reported from the county, and it is possible that they were brought in by some of the students from outside the county or that some of them were not properly identified. Platt listed the following pteridophytes (in many cases under other names): *Lycopodium clavatum*; *L. complanatum* subsp. *flabelliforme*; *Equisetum hyemale* subsp. *affine*; *Botrychium virginianum*; *Osmunda cinnamomea*; *O. claytoniana*; *Adiantum pedatum*; *Athyrium thelypteroides*; *Dennstaedtia punctilobula*; *Dryopteris cristata*; *D. marginalis*; *Onoclea sensibilis*; *Phegopteris hexagonoptera*; *Polypodium virginianum*; *Pteridium aquilinum* subsp. *latiusculum*; and *Thelypteris palustris* var. *pubescens*. So far as is known, none of his specimens has survived the vicissitudes of time. *Equisetum hyemale* subsp. *affine* has not since been reported or collected from Delaware County, but it does occur in the Susquehanna

River valley a few miles away.

A number of people have been interested in the pteridophytes of Delaware County. The earliest known preserved collection from that region is Elizabeth G. Knight's (later Mrs. Nathaniel Lord Britton) specimen of *Polypodium virginianum*, collected at Hancock in 1874 and presently located in the herbarium of the New York Botanical Garden. In 1878 Charles H. Peck, first state botanist, reported *Polystichum braunii* as occurring near Griffins. The only other nineteenth century botanical collector in the county was David L. Topping, who visited North and West Harpersfield in 1895, where he collected *Lycopodium clavatum*, *L. lucidulum*, and *L. obscurum*. An amateur botanist, he also collected extensively in the eastern United States, Borneo, Hawaii, the Philippines, and Siberia; his specimens are located in Minnesota and at the U. S. National Herbarium. Topping made two other visits to Delaware County, one in 1906 and another in 1920.

The last fifty years have witnessed more activity in Delaware County than did the preceding century, and practically all botanical records of the region have been made since 1900. Fanny A. Mulford, a member of the Torrey Botanical Club, visited the Deposit and Arkville areas in 1903 and returned to Arkville in 1915. Percy Wilson, of the New York Botanical Garden, also collected in Arkville in 1915. Edmund N. Harvey, Associate Professor of Botany at the University of Pennsylvania, explored the Arkville area in 1905, and George F. Cleveland, a member of the American Fern Society, collected at North Franklin in 1907. Philip Dowell, first editor of the American Fern Journal, and Norman Taylor, author of *Flora in the Vicinity of New York*, attended a botanical symposium at Stamford during the first week of July, 1909, and took this occasion to climb Mt. Utsayantha and collect in other localities near Stam-

ford. Taylor also collected in the Arkville area about the same time. Wilson visited Stamford in 1913 and collected quite extensively in the Arkville area again in 1915. Herbert M. Denslow, a charter member of the Torrey Botanical Club and honorary curator of the local herbarium at the New York Botanical Garden, collected in Arkville in 1920 and visited Walton and Tompkins in 1927. Aravilla M. Taylor, a member of the American Fern Society, visited a farm near Andes in 1923, reporting her finds in the *American Fern Journal*, and Neil Hotchkiss, at one time on the staff of the New York State Museum, visited the Delhi region in 1927. The only person to collect extensively in the entire region is Mrs. Elsie G. Whitney, a member of the American Fern Society, who made nearly 100 collections of pteridophytes from various sections of Delaware County in 1929, 1930, 1933, 1935, and 1936. Her collections are in the herbarium of the New York State Museum, where she was for some time a member of the staff.

Records of pteridophytes from Delaware County are not numerous. Of the 19 towns into which the county is divided, no ferns have been collected from Bovina, and fewer than 10 collections have been made from each of the towns of Andes, Colchester, Deposit, Franklin, Hamden, Harpersfield, Masonville, Meredith, and Tompkins. Excepting one collection made in Franklin, records of that area rest on Platt's list, and until this past summer our only knowledge of the fern flora of Andes was contained in Dr. Aravilla M. Taylor's article, "Some Pteridophytes of the Western Catskills." The towns best covered include Davenport, Delhi, Kortright, Middletown, and Stamford, which together account for over two-thirds of the collections for the entire county. Collections from the other four towns, Hancock, Roxbury, Sidney, and Walton, total only 53, as shown in the fol-

lowing table:

Records of Delaware County Pteridophytes
Arranged by Towns

Town	Printed Records	Collec- tions	Sight Records	Total Records	Number of Species
Andes	35	1	13	49	34
Bovina	.....	.....	18	18	18
Colchester	.....	7	1	8	8
Davenport	.....	20	8	28	22
Delhi	.....	35	79	114	32
Deposit	....	1	.....	1	1
Franklin	16	1	.....	17	16
Hamden	.....	2	.....	2	2
Hancock	.....	14	23	37	26
Harpersfield	.....	7	11	18	16
Kortright	.....	48	52	100	37
Masonville	.....	7	.....	7	7
Meredith	.....	4	.....	4	3
Middletown	1	61	34	96	38
Roxbury	.....	12	12	24	20
Sidney	.....	14	.....	14	12
Stamford	6	22	7	35	30
Tompkins	.....	1	.....	1	1
Walton	.....	13	.....	13	11
Total	58	270	258	586	54

The above table shows beyond doubt that our knowledge of the fern flora of Delaware County is far from complete with respect to the number of species occurring in the various towns and to the distribution of those species throughout the county. Assuming that it is not unreasonable to expect at least 30 species in each town, only 5 have been explored sufficiently to reach that goal, and records for 7 towns contain fewer than 15 species each.

The list of pteridophytes given below contains not only the names of the ferns known to grow in Delaware County (together with the towns from which they have been collected) but also the authority for placing the name on the list and some indication of the frequency

with which the species occurs in the area. In determining the authority for including a given species, the first specimen collected has been cited. In a few instances, however, no specimens have yet been collected and the authority rests on printed records alone; reference has been made to the Platt list only where no other authority exists for including a given species. Final authority for including a given name in the list should ultimately rest only on specimens collected; in the present instance, however, the names of species not yet represented in collections have been included in part as a matter of historical record and in part to point up the possibility of finding certain species or varieties.

The question of the frequency with which a particular species occurs in any given area is often difficult to determine because of the lack of definite criteria for making any given designation. The admittedly subjective designations incorporated in the following list are arranged in descending order as follows: (1) rare, (2) infrequent, (3) scattered, (4) common, and (5) abundant. No one familiar with the Catskill flora will deny that *Dryopteris austriaca*, var. *intermedia* is abundant; it can be encountered in practically every woodlot in the county. *Dryopteris goldiana*, on the other hand, presents some problems. Ordinarily it is considered rather rare, but it is not infrequent in the county and "scattered" seems a more appropriate designation than "infrequent" or "rare," although it is no doubt less common than *Dryopteris cristata*, which is also "scattered." It is hoped that additional field-work and the application of more objective standards may ultimately result in more accurate determinations of relative abundance.

LYCOPODIACEAE

LYCOPodium annotinum L.

Arkville: *Mulford & Wilson* 29-31 May 15 (NY Local).²

Infrequent; *Andes*,³ Davenport, *Delhi*, *Hancock*, Harpersfield, Kortright, Middletown, Stamford. Specimens from five towns are var. *acrifolium* Fern.

LYCOPODIUM CLAVATUM L.

N. Harpersfield: *Topping*, 2 Oct 95 (MIN).

Scattered; *Andes*, *Bovina*, Delhi, *Hancock*, Harpersfield, Kortright, Middletown, Stamford, Walton. Var. *megastachyon* Fern. & Bissel, has been reported from Andes: A. M. Taylor, *Amer. Fern Journ.* 14: 86, 1924.

LYCOPODIUM COMPLANATUM L. subsp. FLABELLIFORME (Fern.) Clausen

Arkville: *E. N. Harvey*, 1905 (NY).

Abundant; *Andes*, *Bovina*, Davenport, Delhi, *Franklin*, *Hancock*, Harpersfield, Kortright, Middletown, *Roxbury*. A collection by F. Mulford (1903—Brooklyn) from Deposit has been regarded as a hybrid of this species and *L. tristachyum*.

LYCOPODIUM LUCIDULUM Michx.

N. Harpersfield: *Topping*, 2 Oct 95 (MIN).

Scattered; *Andes*, *Bovina*, Davenport, Delhi, Hamden, *Hancock*, Harpersfield, Kortright, Masonville, Middletown, *Roxbury*, *Tompkins*.

LYCOPODIUM OBSCURUM L.

W. Harpersfield: *D. L. Topping*, 2 Oct 95 (US).

Common; *Andes*, *Bovina*, Davenport, Delhi, *Hancock*, Harpersfield, Kortright, Meredith, Middletown, *Roxbury*, Stamford, Walton. Var. *dendroideum* (Michx.) D. C. Eat. has been collected in Stamford and Walton.

LYCOPODIUM SABINIFOLIUM Willd.

Delhi: *N. Hotchkiss* 2045, 10 May 27 (CU).

Rare; Delhi. Only two other collections in New York State are reported by House in his *Annotated List*.

LYCOPODIUM TRISTACHYUM Pursh

Stamford: *N. Taylor* 622, 3-10 Jul 09 (NY Local).

Scattered; *Andes*, *Delhi*, Kortright, Middletown, Stamford,

² The abbreviations used for herbaria follow Index Herbariorum (1952): BKL, Brooklyn Botanical Garden; Brooks, herbarium of Karl L. Brooks; CU, Cornell University; MIN, University of Minnesota; NY, New York Botanical Garden; NYS, New York State Museum; PENN, University of Pennsylvania; US, U. S. National Herbarium.

³ No specimens have been collected from the towns given in italics; knowledge that the species occurs in that area rests either on a sight record or on a printed record.

Walton.

EQUISETACEAE

EQUISETUM ARVENSE L.

Davenport: *Whitney* 5009, 17 Jun 36 (NYS).

Abundant; Colchester, Davenport, *Delhi*, *Hancock*, *Harpersfield*,
Kortright, *Middletown*, *Stamford*.

EQUISETUM HYEMALE L. subsp. AFFINE (Engelm.) Stone

Franklin: *M. Platt*, 1840.

Has not yet been collected in the county, although reported from
Franklin.

EQUISETUM × LITORALE Kuhl. (E. arvense × E. fluviatile)

Hancock: *S. J. Smith* observation 10 Aug 55

Rare; *Hancock*.

EQUISETUM SYLVATICUM L.

3 mi s by w of W. *Harpersfield*: *Brooks* 1543, 14 Jun 52 (Brooks).

Infrequent; *Delhi*, *Kortright*.

OPHIOGLOSSACEAE

BOTRYCHIUM DISSECTUM Spreng. var. DISSECTUM

3 mi s by w of W. *Harpersfield*: *Brooks* 935, 22 Sep 51 (Brooks).

Scattered; *Kortright*.

BOTRYCHIUM DISSECTUM Spreng. var. OBLIQUUM (Muhl.) Clute

Arkville: *F. Mulford*, 1903 (BKL).

Scattered; *Delhi*, *Kortright*, *Middletown*.

BOTRYCHIUM LANCEOLATUM (Gmel.) Rupr. subsp. ANGUSTISEG-
MENTUM (Pease & Moore) Clausen

Stamford: *P. Dowell* 5800, 6 Jul 09 (NY, NYS).

Rare; *Andes*, *Kortright*, *Middletown*, *Sidney*, *Stamford*.

BOTRYCHIUM MATRICARIIFOLIUM A. Br.

Arkville: *F. Mulford*, 1903 (BKL).

Scattered; *Andes*, *Davenport*, *Hamden*, *Kortright*, *Middletown*,
Sidney, *Stamford*.

BOTRYCHIUM MULTIFIDUM (Gmel.) Rupr. subsp. MULTIFIDUM

Meridale: *Whitney* 4459, 26 Jul 35 (NYS).

Rare; *Meredith*.

BOTRYCHIUM MULTIFIDUM (Gmel.) Rupr. subsp. SILAIFOLIUM
(Presl) Clausen

Arkville: *Denslow*, 29 Jul 20 (NYS).

Rare; *Meredith*, *Middletown*.

BOTRYCHIUM ONEIDENSE (Gilb.) House

Arkville: *E. M. Harvey*, 1905 (NY).

Rare; *Middletown*.

BOTRYCHIUM SIMPLEX E. Hitchc.

Catskill Mts.: *F. C. Buckheister*, Jun 09—Ohio State Univ.
Rare; Stamford (?).

BOTRYCHIUM VIRGINIANUM (L.) Swartz

Arkville: *F. Mulford*, 1903 (BKL).

Common; *Andes, Bovina, Davenport, Delhi, Franklin, Hancock, Kortright, Middletown, Roxbury, Sidney, Stamford, Walton.*

OPHIOGLOSSUM VULGATUM L.

S. Kortright: *Brooks & Smith* 1763, 19 Jul 52 (Brooks, NYS).

Rare; *Andes, Kortright.*

OSMUNDACEAE

OSMUNDA CINNAMOMEA L.

Arkville: *E. N. Harvey*, 1905 (NY).

Common; *Andes, Davenport, Delhi, Franklin, Hancock, Harpersfield, Kortright, Middletown, Roxbury, Stamford.*

OSMUNDA CLAYTONIANA L.

Arkville: *E. N. Harvey*, 1905 (NY).

Common; *Andes, Bovina, Colchester, Delhi, Franklin, Hancock, Kortright, Middletown, Stamford.*

OSMUNDA REGALIS L. var. SPECTABILIS (Willd.) Gray

Stamford: *N. Taylor* 807, 1909 (NY, NYS).

Scattered; *Delhi, Hancock, Middletown, Stamford.*

POLYPODIACEAE

ADIANTUM PEDATUM L.

Arkville: *E. N. Harvey*, 1905 (NY).

Common; *Andes, Colchester, Delhi, Franklin, Hancock, Kortright, Middletown, Sidney, Stamford, Walton.*

ASPLENIUM PLATYNEURON (L.) Oakes

Arkville: *H. M. Denslow*, 20 Aug 20 (NYS).

Infrequent; *Andes, Hancock, Kortright, Middletown.*

ASPLENIUM RHIZOPHYLLUM L.

Arkville: *H. M. Denslow*, 10 Jul 20 (NYS).

Rare; Middletown.

ASPLENIUM TRICHOMANES L.

Arkville: *E. N. Harvey*, 1905 (NY).

Infrequent; *Colchester, Middletown, Roxbury.*

ATHYRIUM FILIX-FEMINA (L.) Roth subsp. ANGUSTUM (Willd.)

Clausen

Gould School: *Whitney* 3503, 12 Jun 33 (NYS).

Common; *Andes, Bovina, Davenport, Delhi, Hancock, Harpersfield, Kortright, Masonville, Middletown, Roxbury, Sidney, Stamford.*

ATHYRIUM PYCNOCARPON (Spreng.) Tidestr.

Arkville: *P. Wilson*, 1915 (BKL).

Infrequent; *Andes*, Kortright, Middletown.

ATHYRIUM THELYPTEROIDES (Michx.) Desv.

Arkville: *E. N. Harvey*, Jul 05 (NY, PENN).

Common; *Andes*, *Bovina*, *Delhi*, *Franklin*, Kortright, Masonville, Middletown, Roxbury, Sidney, Stamford, Walton.

CRYPTOGRAMMA STELLERI (S. G. Gmel.) Prantl

Arkville: *F. A. Mulford*, 1903 (BKL).

Rare; Middletown.

CYSTOPTERIS BULBIFERA (L.) Bernh.

Delhi: *Brooks* 3093, 11 Jul 54 (Brooks, NYS).

Rare; Delhi, Middletown.

CYSTOPTERIS FRAGILIS (L.) Bernh. var. MACKAYI Lawson

Hubbel's Cove: *Whitney* 958, 30 May 29 (NYS).

Scattered; *Andes*, Colchester, Davenport, Delhi, *Hancock*, Kortright, Middletown, Roxbury, Sidney, Stamford.

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore

Gould School: *Whitney* 3498, 12 Jun 33 (NYS).

Abundant; *Andes*, *Bovina*, *Delhi*, *Franklin*, *Hancock*, *Harpersfield*, Kortright, Middletown, Roxbury, Stamford.

DRYOPTERIS AUSTRIACA (Jacq.) Woy. subsp. AUSTRIACA

Stamford: *P. Dowell* 5801, 6 Jul 09 (NYS).

Rare; Stamford.

DRYOPTERIS AUSTRIACA (Jacq.) Woy. var. INTERMEDIA (Muhl.) Morton

Roxbury: *Whitney* 3449, 9 Jun 33 (NYS).

Abundant; *Andes*, *Bovina*, Davenport, Delhi, *Hancock*, Kortright, Middletown, Roxbury, Sidney, Stamford, Walton.

DRYOPTERIS AUSTRIACA (Jacq.) Woy. subsp. SPINULOSA (Müll.) Schinz & Thell.

Davenport: *Whitney* 5032, 17 Jun 36 (NYS).

Scattered; Davenport, Kortright, Roxbury.

× DRYOPTERIS BOOTHII (Tuckerm.) Underw. (D. AUSTRIACA VAR. INTERMEDIA × D. CRISTATA)

Stamford: *N. Taylor* 757, 1909 (NYS).

Infrequent; Davenport, Kortright, Stamford.

DRYOPTERIS CLINTONIANA (D. C. EATON) Dowell

Andes: *A. M. Taylor* (*Amer. Fern Journ.* 14: 87, 1924).

Rare; *Andes*.

DRYOPTERIS CRISTATA (L.) A. Gray

Stamford: *P. Dowell* 5816, 7 Jul 09 (NYS).

Scattered; *Andes*, Davenport, *Franklin*, Kortright, Stamford.

DRYOPTERIS GOLDIANA (Hook.) A. Gray

6 mi nw of Andes: *Brooks* 329, 25 Jun 51 (NYS).

Scattered; *Andes*, *Delhi*, *Kortright*, *Stamford*.

DRYOPTERIS MARGINALIS (L.) A. Gray

W. Kortright: *Whitney* 5045, 17 Jun 36 (NYS).

Abundant; *Andes*, *Bovina*, *Davenport*, *Delhi*, *Franklin*, *Harpersfield*, *Kortright*, *Middletown*, *Roxbury*, *Sidney*, *Stamford*.

GYMNOCARPIUM DRYOPTERIS (L.) Newm.

Arkville: *E. N. Harvey*, 1905 (NY).

Scattered; *Andes*, *Bovina*, *Colchester*, *Davenport*, *Delhi*, *Hancock*, *Harpersfield*, *Kortright*, *Masonville*, *Middletown*, *Roxbury*, *Stamford*.

MATTEUCCIA STRUTHIOPTERIS (L.) Todaro

Arkville: *E. N. Harvey*, 1905 (NY).

Common; *Andes*, *Davenport*, *Delhi*, *Franklin*, *Hancock*, *Kortright*, *Middletown*, *Roxbury*, *Stamford*, *Walton*.

ONOCLEA SENSIBILIS L.

Masonville: *Whitney* 5113, 19 Jun 36 (NYS).

Abundant; *Andes*, *Bovina*, *Davenport*, *Delhi*, *Franklin*, *Hancock*, *Harpersfield*, *Kortright*, *Masonville*, *Middletown*, *Roxbury*, *Stamford*.

PHEGOPTERIS CONNECTILIS (Michx.) Watt

Gould School: *Whitney* 3509, 12 Jun 33 (NYS).

Infrequent; *Andes*, *Colchester*, *Delhi*, *Hancock*, *Sidney*, *Stamford*.

PHEGOPTERIS HEXAGONOPTERA (Michx.) Fée

Andes: A. M. Taylor (*Amer. Fern Journ.* 14: 87, 1924).

Rare; *Andes*, *Franklin*.

POLYPODIUM VIRGINIANUM L.

Hancock: *E. G. Knight*, 1874 (NY Local).

Common; *Andes*, *Bovina*, *Davenport*, *Delhi*, *Franklin*, *Hancock*, *Harpersfield*, *Kortright*, *Meredith*, *Middletown*, *Roxbury*, *Sidney*, *Stamford*.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott

Arkville: *E. N. Harvey*, 1905 (NY).

Abundant; *Andes*, *Bovina*, *Colchester*, *Davenport*, *Delhi*, *Hancock*, *Harpersfield*, *Kortright*, *Masonville*, *Middletown*, *Roxbury*, *Sidney*, *Stamford*, *Walton*.

POLYSTICHUM BRAUNII (Spencer) Fée var. **PURSHII** Fern.

Arkville: *E. N. Harvey*, 1905 (NY).

Rare; *Delhi*, *Middletown*.

PTERIDIUM AQUILINUM (L.) Kuhn subsp. **LATIUSCULUM** (Desv.)

Hulten

Arkville: *E. N. Harvey*, 1905 (NY).

Common; *Andes, Bovina, Delhi, Franklin, Hancock, Harpersfield, Kortright, Middletown, Roxbury, Walton.*

THELYPTERIS NOVEBORACENSIS (L.) Nieuwl.

Gould School: *Whitney 3496, 12 Jun 33 (NYS).*

Abundant; *Andes, Bovina, Davenport, Delhi, Hancock, Harpersfield, Kortright, Masonville, Middletown, Stamford, Walton.*

THELYPTERIS PALUSTRIS Schott var. PUBESCENS (Lawson) Fern.

Arkville: *E. N. Harvey, 1905 (NY).*

Common; *Andes, Bovina, Davenport, Franklin, Hancock, Kortright, Middletown, Roxbury.*

If one were to point up one surprising feature of the fern flora of Delaware County, it would no doubt be the occurrence of such limestone-loving species as *Cystopteris bulbifera*, *Cryptogramma stelleri*, and *Asplenium rhizophyllum*. There are no outcroppings of limestone in the Catskills; the explanation must therefore lie in the fact that some of the Catskill shales contain relatively large amounts of lime. As a matter of record, *Acer nigrum* Michx. f., *Hackelia americana* (A. Gray) Fern., and *Oryzopsis racemosa* (Sm.) Ricker likewise occur in the area—three other plants which demand calcareous soils.

A critical examination of the above list discloses a number of singular omissions. *Selaginella*, *Isoëtes*, and *Woodsia*, for example, are conspicuous by their absence. *Selaginella rupestris* (L.) Spring, *Isoëtes echinospora* Durieu, *I. macrospora* Durieu, *I. riparia* Engelm., and *Woodsia obtusa* (Spreng.) Torr. have each been collected from one or more neighboring counties. It is to be expected that at least some of these species also occur in Delaware County. In addition, *Equisetum fluviatile*, one of the parents of $\times E. litorale$ L., grows in neighboring Green, Schoharie, and Ulster counties; it should likewise turn up along one of the rivers or lakes of Delaware County. It is thus apparent that additional fieldwork in Delaware County can still supplement our knowledge of the fern flora of this area.

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The First Popular Fern Book

R. C. BENEDICT

A few years ago, a reference was noted to a fern book by an English writer with a publication date of 1790; the author was given as James Bolton,¹ and the title as "Filices Brittanicae." The very early date was a matter of interest and the reference was filed in memory as something to be looked up when time permitted. After ferns themselves, books about them are an interesting phase of fern study and the earliest known volume in English is certainly worthy of a "review." During the fall of 1955, a copy of Bolton was obtained from the New York Botanical Garden by an inter-library loan. Its inspection and some follow-up correspondence have led to the present report.

Two questions are of particular interest: What was the nature of this eighteenth century book? And what influence did it have on the tremendous expansion of British interest in ferns which was characteristic of the nineteenth century?

¹ 1758-1799. The composite, *Boltonia*, was named after him.

There seems to be no question but that Bolton's volume was the pioneer in popular fern literature. One hundred years later, a well-known fern student, James Britten, of the Department of Botany of the British Museum, wrote as follows: "The first book specially devoted to British ferns was James Bolton's handsomely printed '*Filices Britannicae; an History of British proper Ferns*,' which appeared in two parts, the first printed at Leeds in 1785; the second at Huddersfield, in 1790. These two form a quarto volume, containing eighty-one pages of letter-press, and forty-six coloured plates."²

Bolton's purpose may very well be reported in his own words: "What is here attempted is to bring together and illustrate the British proper ferns. No attempt of the kind has ever appeared in our own, or in any other language." He makes the further observation that "many who may wish to be informed on the indigenous plants of our country have neither time nor leisure nor inclination to pursue the Science of Botany in its more extensive track, to purchase the numerous volumes and acquire an understanding of the numerous terms now necessary to be read and understood." In Bolton's effort to avoid technical terms, he adopted a series of simpler ones in his preliminary outline on fern structure. For example, for leaf, pinna, and pinnule, he proposed "first leaf," "second leaf," and "third leaf," respectively. Spore cases are called "seed vessels, the most plain and expressive name I can think of . . . globes or separate seed vessels are of a figure truly spherical and are attached to the

² James Britten. *European Ferns*. Cassell, Potter, and Halpin. 1890. Incidentally, Britten's volume is indicated by its author as the first on the ferns of Europe or any part of continental Europe written for the general reader; earlier treatises had been addressed to professional botanists. He comments, also, that at least up to 1890, fern study as a wide-spread amateur pursuit had been limited to English-speaking peoples.

surface of the leaf by a short footstalk. They are surrounded by a circular chain, or elastic ring, which, when the seeds are ripe, breaks and tears open the shell in a vertical fashion."

Bolton has been referred to as an "Eighteenth century naturalist." He published popular books on two other nature subjects—on fungi, and on birds. His "An History of the fungusses growing about Halifax" (1788–1794) was reprinted in German and has earned him the characterization of "gifted amateur," with special reference to his plates. Under the happy title of "Harmonia ruralis" (1794) he published a volume on British songbirds. In 1845, a reprint of the bird book was published from the original plates, except for a different introduction. The fungus book I have not seen, but the bird and fern volumes reveal a man with a strong love of nature and careful observation of the things he was writing about. Some further words from the introduction to the fern book present it as "for those who are desirous to inform themselves of a tribe of plants so singular and beautiful as the British proper ferns must be allowed to be."

Amateur he may have been, but his fern book shows him to have possessed keen discernment, intelligently critical of the current Linnaean system of classification on which his technical names were based. Using the classification then common, he presents 33 species under seven genera: *Ophioglossum*, *Osmunda*, *Acrostichum*, *Pteris*, *Asplenium*, *Polypodium*,³ and *Trichomanes*. His *Osmunda* includes species of four different genera as we regard them today: *Osmunda regalis*, *Botrychium Lunaria*, *Cryptogramma crispa*, and *Blechnum spicant*. His own comment shows his dissatisfaction with this assemblage: "It must offend the taste of the judicious

³ Misspelled "*Polipodium*" through the text but corrected in the list of Errata.

reader to find the characteristics of the genera fixed on foundations so unsteady when he finds plants very dissimilar in appearance united; as also when he sees a separation between *Ophioglossum vulgatum* and *Botrychium Lunaria*, between *Acrostichum septentrionale* [a true *Asplenium*] and *Asplenium Ruta-muraria*." *Acrostichum* was for many years after Bolton a catch-all genus for many diverse fern species that, when mature, have an appearance of massed spore cases on the backs of their leaves. Bolton notes this but observes that "some *Acrostichums*, when young, belong in *Asplenium*."

Of the other genera, with several species, *Asplenium* is the most natural according to present ideas. His *Polypodium* comprised besides true polypody, representatives of *Woodsia*, *Dryopteris*, *Cystopteris*, *Athyrium*, *Polystichum*, *Phegopteris*, *Thelypteris*, and *Gymnocarpium*, to use the most recent generic names indicated by two British fern students of today, Irene Manton and Stanley Walker.

Since Bolton was writing for the general public, he naturally indicated for each species a "common" or English name. Some of these, even more than is true of the common names used in recent fern books, bear little relationship to the scientific classification of his time. For example, most of the true aspleniums are designated "maidenhairs," a usage that may have arisen from the widespread use of a good many ferns in recipes of the kitchen, or as herbs in medicine. *Adiantum Capillus-veneris* is referred to as "true maidenhair." *Blechnum* (his *Osmunda*) *spicant* is called "rough spleenwort." For some of the species he places in *Polypodium*, the English name is merely a translation of the latin technical name, e.g., "marsh polypody," "crested polypody."

Was Bolton's volume the starting point from which

developed the very extensive interest and publication which characterized British fern study during the nineteenth century? The answer to that question seems to be completely negative. A search through a score or more of the fern authors of both the first and second half of the 19th century turned up only two or three citations. In a letter, the Rev. E. A. Elliot, a member of the American Fern Society and long active in the British Pteridological Society, suggests the reason: "Speaking generally, and from memory, I should say Bolton got forgotten when the big outburst of fern interest began, and Newman and Moore began writing; and therefore Bolton never much influenced fern study. He seems usually referred to as an original authority for the occurrence of this or that species in Great Britain."

Soon after Bolton's time, long before Newman and Moore, professional botanists began to depart from the Linnaean conceptions as to fern genera. Quantities of herbarium collections were received from all over the world, and many new species and genera had to be recognized. During the same period, John Smith, curator of ferns at the Royal Botanic Gardens at Kew, placed great emphasis on the study of living fern material. During his 41 years of service at Kew, he reports that the tropical fern collection grew from 40 species in 1823 to 1084 in 1864 when he retired.⁴ Tropical ferns as an amateur pursuit attained a considerable vogue and this continued at least until the time of the first World War. I have in front of me the "Amateur Guide and Catalogue" of H. B. May and Sons, of Upper Edmonton, England, which was put out apparently in 1913.⁵ The catalog introduction states that "upwards of two thousand species and varieties" are listed and available for sale. In 95 pages

⁴ *Historia Filicum*. 1875.

⁵ No publication date is given but letters dated late in 1912 from pleased customers are included.

of listing, 71 are concerned with tropical species that require greenhouse treatment in Great Britain. Of the remaining 24 pages devoted to hardy ferns, six, listing "hardy exotic" species, include a good number of subtropical origin which would be hardy only in the warmer parts of the United States, *e.g.* species of *Cyrtomium*, *Pteris*, *et al.* The remaining 18 pages are concerned with British species and their multitudinous varieties. Most of these are included in half a dozen species: common polypody, hart's-tongue, lady fern, male fern, and two polystichums—*P. aculeatum* and *P. setiferum* (*P. angulare* of many authors).

The greatest expression of amateur interest in ferns in Great Britain developed after 1850 and centered in the discovery and cultivation of an ever-increasing number of sports from native species. In 1880, Edward Lowe, whose books are perhaps the most extensive expression of this phase of fern interest, stated that over 1100 varieties had been announced and named.⁶ Lowe mentions Bolton, citing him for two things: the recognition of the limestone oak fern as a species distinct from the common oak ferns, and for having called attention to the existence of varieties among British species, *e.g.* *Polypodium vulgare* var. *cambricum*, and "well-known varieties of hart's-tongue."

Obviously, nearly all the nineteenth century expansion of fern study in Great Britain was outside and far beyond the scope of Bolton's *Filices Britannicae*. His interests and the contents of his volume are much closer to the kind of amateur fern study in the United States, from Robinson's first volume in 1878 to the present. His volume contains many more items of interest about the natural history of ferns than could be included in the space of this article.

BROOKLYN, NEW YORK.

⁶ Our Native Ferns.

Spore Studies in Dryopteris. III

FERN WARD CRANE

Two previous articles¹ on *Dryopteris* spores dealt with the “*cristata-clintoniana-spinulosa*” complex. It was established that spore characters are diagnostic for the taxa of that series. This further report of spore studies² includes *Dryopteris arguta* from the Pacific Coast and *D. marginalis*, *D. fragrans* var. *remotiuscula*, and one form of *D. filix-mas* from eastern North America.

The close similarity of the spores of these species is clearly demonstrated by the perispore characters they possess in common. The spores are tan to brown in color; the perispore surfaces and edges are completely glabrous; and the wings are usually small and numerous, varying from separate to continuous.

The smallest spores of the group occur in *D. arguta* (Pl. IX, fig. 1; p. 129, fig. 1) and *D. marginalis* (Pl. IX, fig. 2; p. 129, fig. 2), in which narrow wings, often continuous, give a sculptured appearance to the perispore. The wings in *D. arguta* are more numerous. *D. fragrans* var. *remotiuscula* (Pl. IX, fig. 3; p. 129, fig. 3) bears the largest spores in the series. A tight-fitting perispore is so covered with manifold wings that the spore is tuberculate in general aspect.

Several markedly different types of spores have been observed in specimens identified as *D. filix-mas*, collected from widely scattered sections of North America. The form illustrated here, termed form “A,” is from Bridgewater, Windsor County, Vermont. The treatment and discussion of additional forms is reserved for

¹ THIS JOURNAL 43: 159-169. 1953; 45: 14-16. 1955.

² These studies have been financed by a grant-in-aid from the Penrose Fund of the American Philosophical Society.



I



II



III

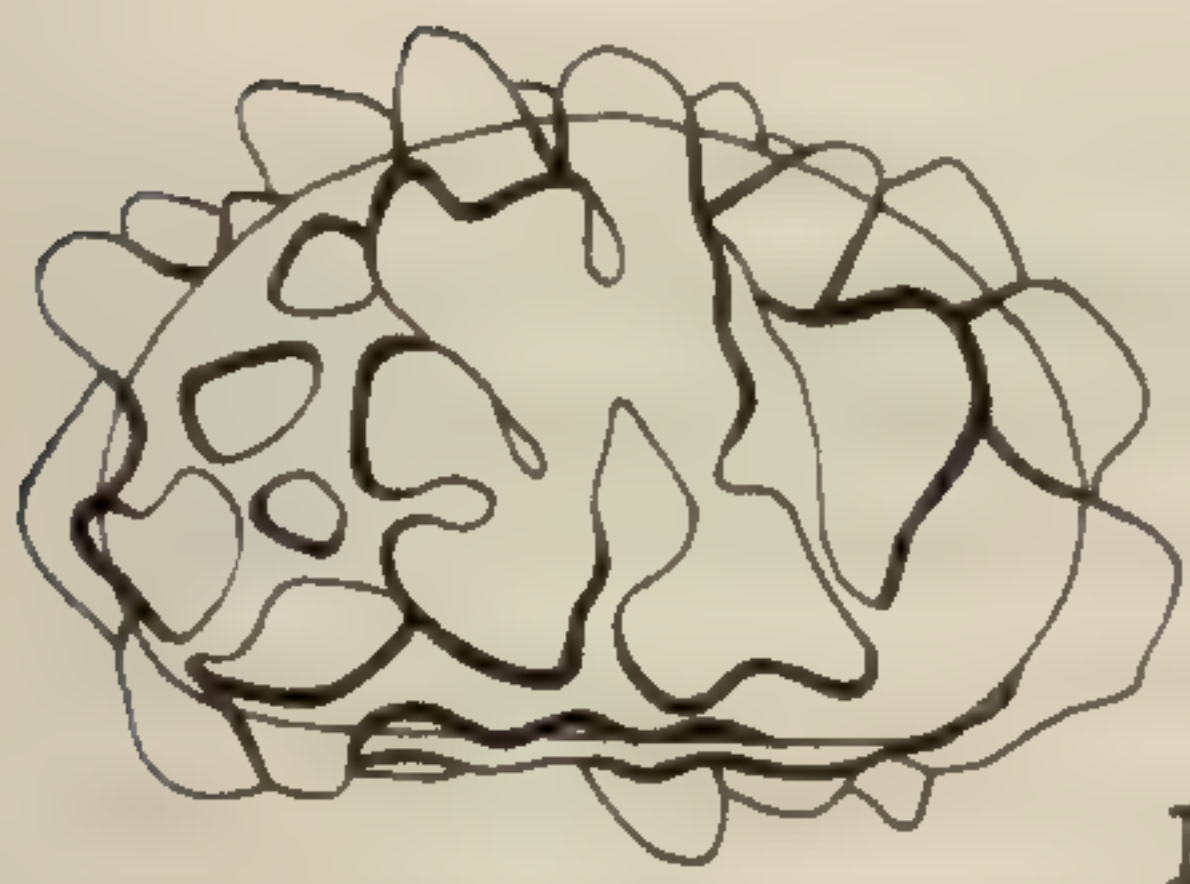


IV

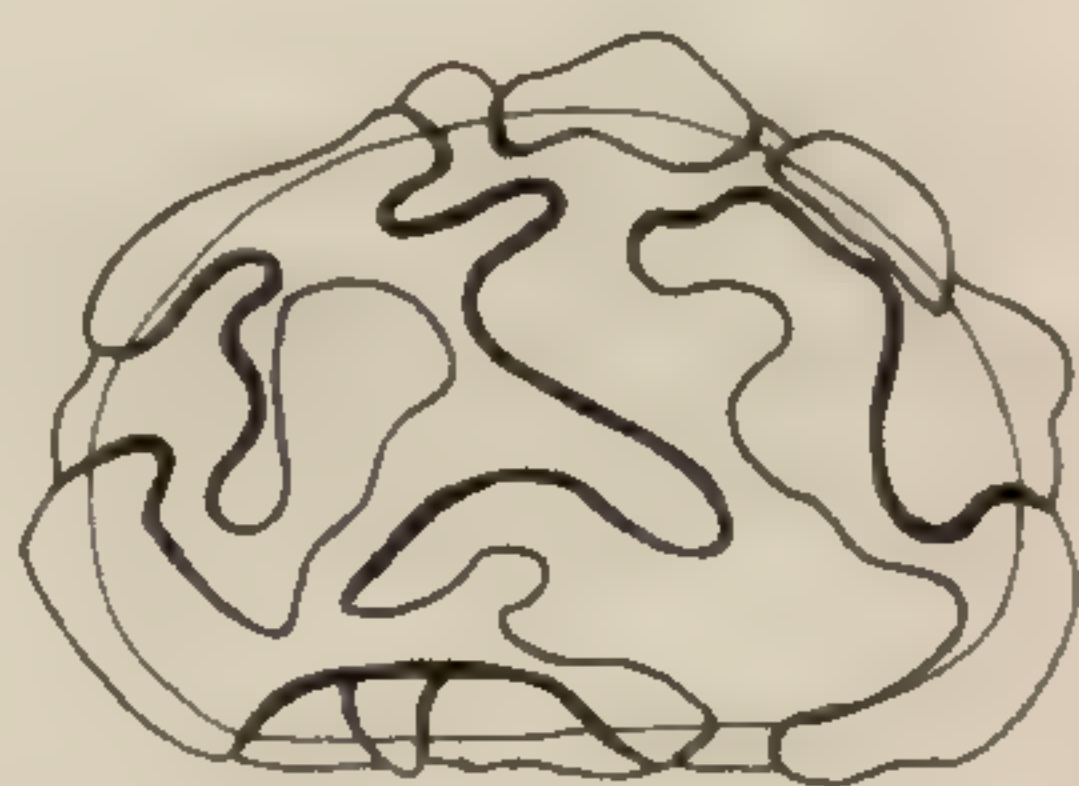
Fig. 1. *Dryopteris arguta*; PIERCEY, MENDOCINO CO., CALIF., O. J. Byers (Crane 54172). Fig. 2. *D. marginalis*; NEAR "LEBANON," LORTON, VA., Crane 5334. Fig. 3. *D. fragrans* var. *remotiuscula*; HAINES FALLS, N. Y., E. T. Wherry (Crane 5036). Fig. 4. *D. filix-mas*; NORTH BRIDGEWATER, VT., Crane 54144.

another paper when it is hoped that cytological data will be available. Rhizomes have been sent to the Universities of Leeds and Liverpool, England, where studies are now in progress. The cytologists' report on the chromosome counts may well lead to a review of *D. filix-mas* in North America.

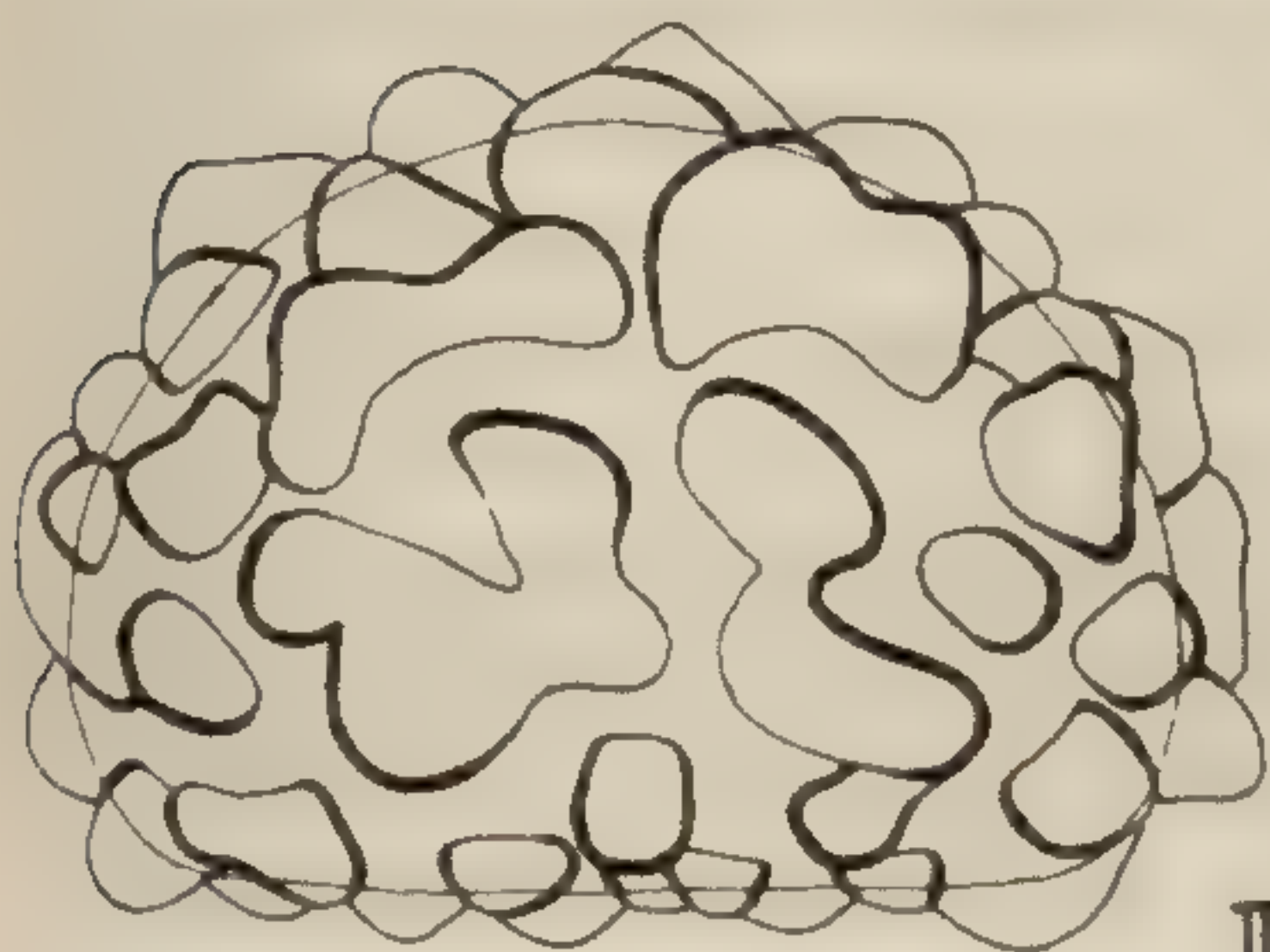
— 30 μ —



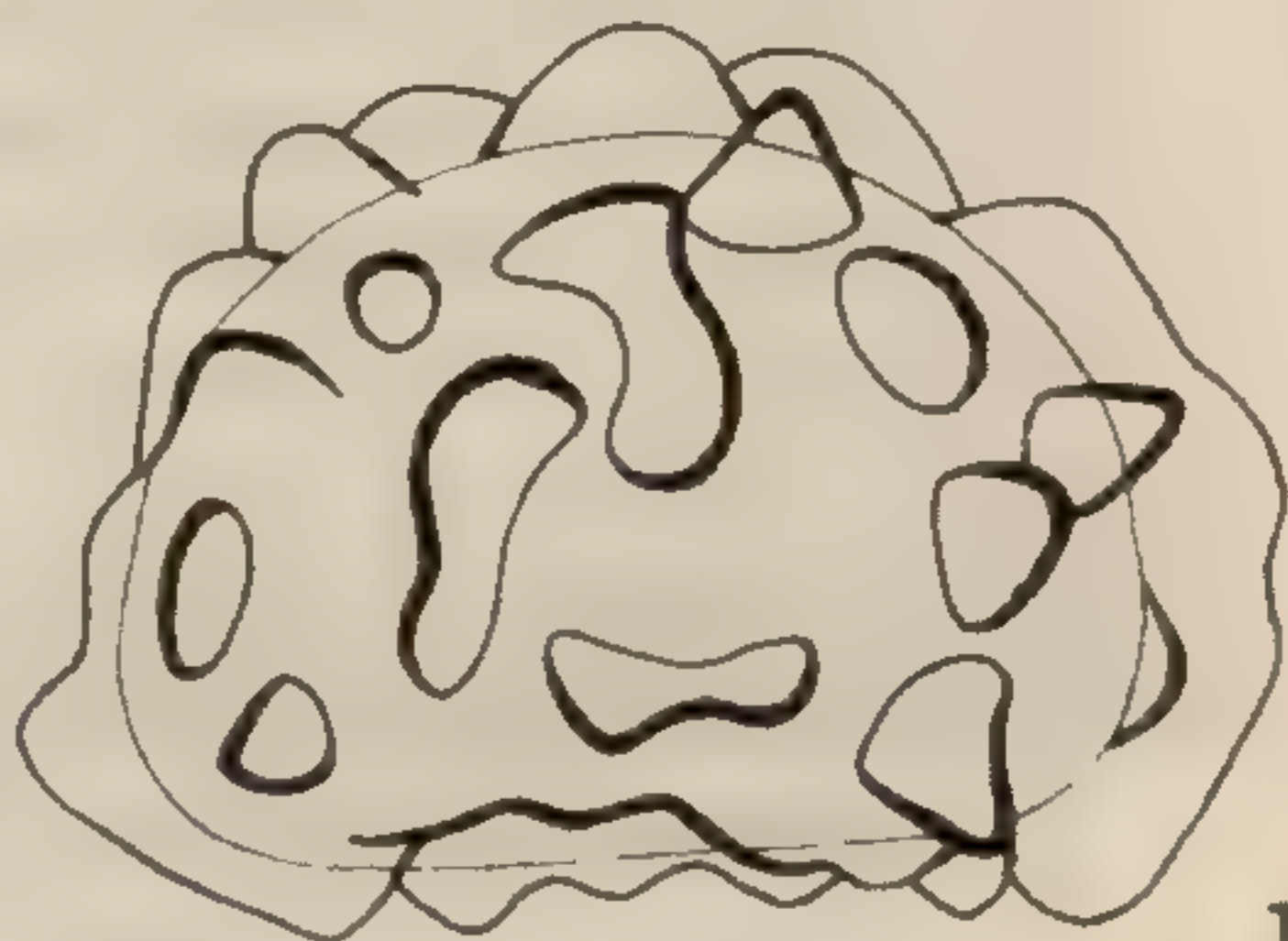
I



II



III



IV

FIG. 1. *DRYOPTERIS ARGUTA*. FIG. 2. *D. MARGINALIS*. FIG. 3. *D. FRAGRANS* VAR. *REMOTIUSCULA*. FIG. 4. *D. FILIX-MAS*.

In general appearance the spores of *D. filix-mas* form "A" (*Pl. IX*, fig. 4; p. 129, fig. 4) resemble those of *D. fragrans* var. *remotiuscula*. However, they are slightly smaller in size and the number of wings is fewer. Plants producing spores of this sort are represented in collections from Newfoundland to Ontario and to Vermont.

Spores of the British *D. filix-mas sens. strict. emend.*³ are quite comparable to those described under form "A." The plants themselves are alike in habit of growth and in morphology, and they live in similar habitats. *D. filix-mas* is one of the most common ferns in woods, hedgerows, and ditches throughout Great Britain; it has been transplanted to gardens of large estates and of small cottages alike. In fact, it seems to be almost a naturalized plant. In eastern North America, on the other hand, this fern is indeed uncommon. The collecting areas are widely scattered and the number of individual plants in any given area is small. Is it possible that the early British colonists brought rhizomes of *D. filix-mas* to America, and our occurrences represent escapes from cultivation? It appears quite conceivable that early settlers wished to transfer a bit of their own country to a new and strange land. And what more familiar and desirable plant could be chosen, since the fern is hardy and easily transported?

It may be concluded that:

1. Spores of *D. arguta*, *D. marginalis*, *D. fragrans* var. *remotiuscula*, and *D. filix-mas* form "A" show striking similarities but still exhibit differential characters peculiar to each fern.

2. Chromosome counts are necessary before further conclusions can be reached on the status of the *D. filix-mas* complex in America.

³ Manton, Irene. Problems of Cytology and Evolution in the Pteridophyta. Cambridge University Press. London. p. 44. 1950.

Ceratopteris deltoidea Disappears from the Type Locality

CHARLES E. DEVOL

The type of *Ceratopteris deltoidea* Benedict was collected in the mouth of the Orange Bay River, Jamaica by Britton and Hollick in March, 1908. It has been collected there also by Harris, Wilson, Sherring, and others. Specimens of these collections are in the herbaria of the U. S. National Museum, New York Botanical Garden, and Missouri Botanical Garden. G. S. Jenman collected it at Clarendon, Jamaica, in 1874 and 1879.

Since I am especially interested in this genus I wrote to George R. Proctor at the Science Museum, The Institute of Jamaica, asking him to collect some specimens for me. He replied that *C. deltoidea* and *C. thalictroides* "have not been seen here for over fifty years. I myself have searched for them during the past six years without success. As a matter of fact, the field trip which took me out when your letter arrived was a visit to the type locality of *C. deltoidea*, near the mouth of the Orange Bay River, but the plants were not to be seen."

C. deltoidea has also been collected in Puerto Rico, where P. Sintenis collected it first in 1886. Britton collected it at Ratillas, Earle at Aguirre, and Hess at Mayaguez. I wrote to Ismael Vélez at the Polytechnic Institute of Puerto Rico to see if he could get me some specimens. In reply Dr. Vélez says that they do not have *Ceratopteris* and enclosed a letter from García Benítez, who wrote he had never found it.

C. deltoidea once grew in Louisiana. The Herbarium of the New York Botanical Garden has specimens collected by Hasse in 1885 at New Orleans, some collected by Cocks in 1890 at Lake Ponchartrain, and by him in 1910 at Bayou Gold. At the suggestion of Donovan S.



Ceratopteris deltoidea; ORANGE BAY RIVER, JAMAICA, MARCH 14, 1908.
William Harris. LOWER LEAF STERILE, UPPER TRANSITIONAL BETWEEN STERILE
AND FERTILE.

Correll, I wrote to Clair Brown regarding the species, and he replied that it is no longer found to be in Louisiana. He remarked that the habitat had evidently been disturbed.

The sterile leaves of *C. deltoidea* are broadly deltoid in outline, the ultimate lobes being large and broad. The stipe is long and stout, but not swollen. The transitional leaves are also broadly deltoid in outline, but with narrowly linear or lanceolate ultimate segments. The fertile leaves are similar in outline to the sterile leaves, but have long narrow ultimate segments, with revolute margins that cover the sporangia. The illustration may help those who are not acquainted with this species to identify it.

Paul C. Standley, who has collected *Ceratopteris* in Central America, writes that it "grows in places where no sensible person would ever look for a fern." It is to be hoped that it will continue to be found in the streams, rivers, lakes, and pools of the West Indies, and in Central and South America.

Shorter Notes

WHAT FERNS MAY BE CLASSED AS WEEDS?—

In a recent issue of the National Horticultural Magazine,¹ B. Y. Morrison reports some experiences with the Japanese climbing fern, *Lygodium japonicum*, usually known as *L. scandens* in horticultural literature. Besides noting that it could be grown successfully as a dooryard plant, he notes that it has been reported as a weed in parts of Alabama, and also quotes a Japanese report that it may be a serious weed in parts of Japan. *Lygodium japonicum* is one of the subtropical species often grown by northern florists for table fern use. It has been reported as hardy with protection as far north as New Jersey. Potted plants can be suc-

¹ Vol. 35: 47, 48.

cessfully grown as house plants in the northern states.

This reference prompted the enquiry of the title of this note, with special reference to northern hardy species, but with interest also in any tropical species which may on occasion qualify as weeds—plants interfering with cultivated crops. Some years ago in response to a statement that our native ferns are never aggressive, never troublesome in relation to crop plants, an exception was noted with respect to cranberry cultivation in eastern Massachusetts. There the common marsh fern and the Virginia chain fern were reported as frequently troublesome invaders of cranberry bogs. The common brake has earned opprobrium both for its invasion of grazing areas and because its foliage is harmful to cattle. Likewise, the common horsetail is harmful browse and may even invade moist situations in ploughed land and lawns.

Under the special conditions of greenhouse fern culture, both commercial and in special collections, spore cultures designed for particular species are often invaded and pre-empted by undesired species, such as *Polypodium aureum*, *Cyrtomium falcatum*, et al. Does any reader know of circumstances in which other fern or pteridophyte species have qualified as troublesome weeds?—R. C. BENEDICT.

A EUROPEAN FERN FOR NORTHERN GARDENS.—Great Britain and continental Europe have contributed very few species to the fern gardens of the United States, particularly where there are severe winters. The types of cultivated hardy ferns available have been chiefly some of the multitudinous varieties of a few species—lady fern, male fern, and two polystichums, *P. aculeatum* and *P. setiferum*, usually known as *P. angulare* among British growers. For that reason, it is interesting to run across a European species, *Athyrium crenatum*

(Forsk.) Kuntze, which should be at home in the coldest parts of the United States. This species was described and figured by James Britten, in his *European Ferns*, published in 1890, and its range given as northern Europe and Asia, from the Scandinavian countries all the way to Japan.

In appearance, from Britten's figure, it looks a little like the rather well known Japanese variegated athyrium, *A. goeringianum* var. *pictum*, the hardiness of which has been well tested. The leaf-blade is, in general, triangular, the stipe thick. Whether it would offer competition in growth and other good qualities to the American athyriums, *A. pycnocarpon* and *A. thelypteroides*, will have to wait trial, but it would be an interesting project to obtain plants for a try-out. Some correspondent who can supply viable spores would confer a favor on American fern gardeners interested in testing this species.

In the preceding paragraphs, I have used the genus name as a common or English name in preference to referring to this fern as some sort of a "lady fern," as has been done with the Japanese variegated species. I do not like the practice of calling athyriums "spleenworts" which dates from an early American misconception of the relationship of these species with true spleenworts. Dr. Wherry has attempted to correct this outmoded use of spleenwort by coining the names "glade fern" and "silverstripe fern" for *A. pycnocarpon* and *A. thelypteroides*. Perhaps these names may receive general acceptance, but, in any event, calling all species of the genus athyriums will be perfectly clear. It will also follow the precedent of using the generic name *Woodsia* as a common name without a capital letter, a practice very familiar in the case of many flowering plants genera, *eg.* gladiolus, delphinium, *et al.*—R. C. BENEDICT.

American Fern Society

LOS ANGELES MEETING. Los Angeles members of the Fern Society, including Mrs. Fay MacFadden, Mr. Fred Kaye, Mrs. Barbara Joe Hoshizaki, and Mr. A. W. Roberts, and guests met August 3 for a dinner and informal meeting which was addressed briefly by the undersigned. Four new members were enrolled, whom we are glad to welcome: Dr. W. C. Drummond, Mr. Paul C. Hutchison, Miss Muriel Merrell, and Mr. Frank X. Montoya. Interest in fern matters is running high in the Los Angeles area, and we may expect to hear more from the enthusiastic group there.—C. V. MORTON.

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American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

C. V. MORTON

R. C. BENEDICT

IRA L. WIGGINS

A. C. SMITH

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No. 4

Observations on Some Bulblet-producing Populations of the *Cystopteris fragilis* Complex

W. H. WAGNER, JR. AND DALE J. HAGENAH

Several years ago, C. V. Morton¹ suggested that members of this Society might profitably cooperate in the study of the American varieties of the fragile-fern, *Cystopteris fragilis*, a group of perplexing variations, some of which might be more than varieties—some even subspecies or species. Since then, the writers have made some suggestive observations which amply justify Morton's viewpoint, and which in some cases will likely lead to a fuller understanding of relationships than we have heretofore possessed. A number of localities have been found in Michigan for a supposed hybrid, *Cystopteris bulbifera* × *fragilis*.² The chromosomes of this plant were studied and shown to number $n = 126$, i.e., it represents the first hexaploid in this genus known in North America, the ferns having six times the presumed basic gametic number for the genus *Cystopteris* rather than two to four times, the numbers known previously.³ (These plants were identified when their chromosomes were reported as "*Cystopteris fragilis* var. *tennesseensis* (Shaver) McGregor," but it now seems probable that

¹ A suggestion for a cooperative study by members of the American Fern Society. This JOURNAL 42 (no. 1): 31–35. 1952.

² Hagenah, D. J., 1955. Notes on Michigan Pteridophytes, I. New County records in Osmundaceae and Polypodiaceae. This JOURNAL 45 (no. 2): 65–81.

³ Wagner, W. H., 1955. Cytotaxonomic observations on North American ferns. Rhodora 57 (no. 680): 219–240. [Volume 46, No. 3, of the JOURNAL, pp. 97–136, was issued October, 16, 1956.]



LEFT: BULBLET PRODUCING CYSTOPTERIS OF THE GLANDULAR VARIETY, TROUT LAKE, MICH. RIGHT: GLANDLESS VARIETY, BERNVILLE, BERKS CO., PENNSYLVANIA.

they are not identical with that variety, and, in fact, that they may represent an undescribed taxon.) Intensive studies are now being pursued at the University of Michigan of this and other members of the *Cystopteris fragilis* complex, utilizing three approaches especially: (1) Growing plants of different varieties side-by-side under uniform conditions; (2) making anatomical studies of pinnae and sori by the clearing technique; and (3) comparing spore structure and size. Regarding the first approach in particular, we wish to solicit members of the Fern Society throughout the United States (and in foreign countries also) to help by sending living rhizomes of populations from their areas. We feel strongly that interesting populations of this group of ferns are often overlooked—especially those that form bulblets along the rachis; the bulblets are commonly very small and are often only one on a frond (see *Pl. XII, b₁*). (For example, some of the materials referred by Weatherby to var. *laurentiana* have since proved to have bulblets, e.g., from Iles du l'Étang-du-Nord, Victorin & Rolland-Germain 9333, GH.) The bulblet-producing populations have so recently been recognized that there are great gaps in their presently known distribution; and for many states (e.g., Ohio, Indiana, Kentucky, Wisconsin, and many others) where they almost surely occur, there are no records at all. For this reason, we believe that the following observations on the bulblet-bearing populations known to us will be of value. We have also included some notes sent to us by Dr. R. L. McGregor and Mr. Joseph S. Krakow. Dr. Reed C. Rollins kindly lent us the material of *Cystopteris* in the Gray Herbarium for study.

We hesitate at this time to identify our populations with any assurance, so we shall merely call them here the "glandless variety" (*Pl. XI*, the frond on the right); and the "glandular variety" (frond on the left). Our glandless variety (which is perhaps "*forma simulans*

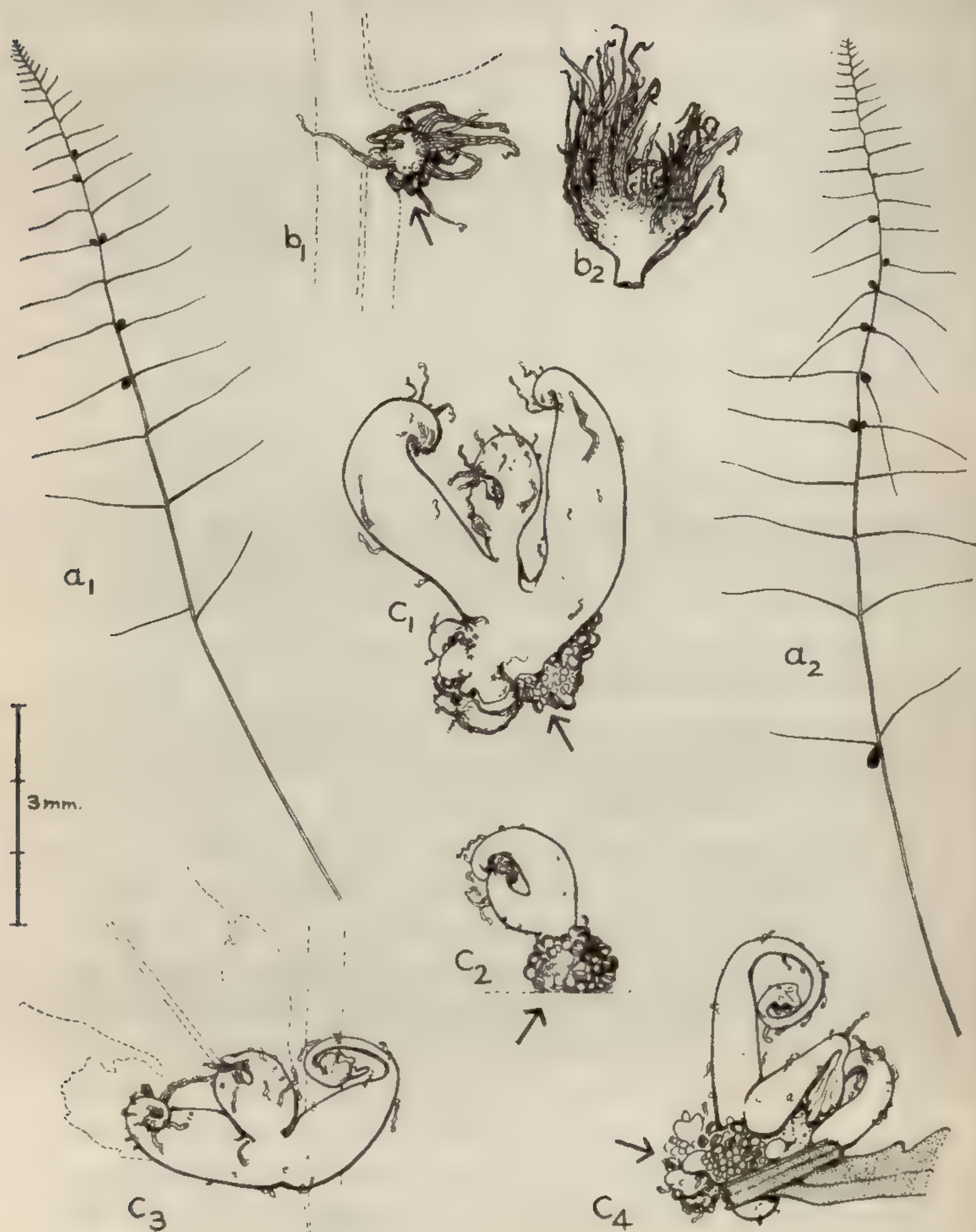


Plate XII. a_1 and a_2 . Tracings of dried garden-grown leaves of the glandular bulblet-producing *Cystopteris* from Trout Lake, Michigan, to show the relationship of the bulblet positions to the major axes; not to scale. b and c . Habit drawings of bulblets; to scale. The arrows point to the areas where sporangia have been produced: b_1 and b_2 . The glandular variety from Trout Lake; c_1 , c_2 , c_3 , c_4 : The glandless variety from Catoctin Furnace, Maryland (very large and well-developed bulblets collected by E. T. Wherry; c_4 has a leaf fragment still attached)

Weatherby'') was found in 1943 in an old iron furnace at Catoctin, Maryland, by Wagner⁴ and was later encountered in the old canal locks at Bernville, Berks County, Pennsylvania. Dr. Wherry kindly revisited both of these localities for us and sent living plants. Our glandular variety (which now appears to be distinct from "var. *tennesseensis*") was discovered by Hagenah first in 1949 in Gogebic Co., Michigan, and subsequently located in a number of places in the northern Great Lakes region.

One of the curious facts concerning the bulblet-producing entities is that none of their populations has ever been recorded growing directly on soil, i.e., terrestrially—although *Cystopteris bulbifera*, *C. fragilis* var. *mackayi* and *C. fragilis* var. *protrusa* are, of course, known to do so abundantly. All the populations that have been found are growing upon rocks, usually on more or less vertical walls of rock cliffs, either sandstone or limestone, or on the man-made walls of canals or iron furnaces. McGregor, who has probably seen more living populations of bulblet-producing varieties in the field than any other worker, has had the same experience, and he writes (Oct. 5, 1953) that "I have never taken a plant from the ground." It is possible, however, that they will turn up in terrestrial situations, especially since awareness of the distinctness of these plants has only recently been pointed out. Field workers should look out for terrestrial populations. One observation that may help us locate bulblet-producing populations in terrestrial situations is that they appear to be more frost-resistant than the more typical varieties of *C. fragilis*.

Bulblets were first noticed in plants considered to be varieties of *C. fragilis* as early as 1933 by Elizabeth Pinkerton, but her discovery seems not to have attracted

⁴ Another occurrence of the apparent hybrid *Cystopteris*. This JOURNAL 34 (no. 4): 125-127.

attention.⁵ Although the bulblets have been repeatedly compared with those of *C. bulbifera*, they actually have very definite differences. With respect to their positions on the fronds, those of the "hybrid" varieties tend to occur singly or a few at a time along the rachis at the junctures of the pinnae, either at the extreme base of the blade (as in some of the Great Lakes material), or in the upper half or third of the blade (*Pl. XII, a*). They are very rarely—almost never—found on the pinnae. In *C. bulbifera* the bulblets are borne abundantly on the dorsal sides of the costae of the leaflets, and they are usually much more common than in the present forms. Another and very marked contrast, furthermore, is that in *C. bulbifera* they seem readily to abscise, and one rarely encounters a specimen of this species in the herbarium upon which all the bulblets have remained.

The bulblets of *C. bulbifera* are frequently illustrated, and in their details they deviate quite noticeably from those in the *C. fragilis* complex. In general, the bulblets of *C. bulbifera* are essentially symmetrical, nearly round, with two very succulent, hemispherical "cotyledons," between which the shoot apex later grows. The bulblets when mature (contrary to Shaver's illustration⁶) are usually almost entirely naked, with a shiny epidermis, as was beautifully illustrated by Geske.⁷ The bulblets of the "hybrid" plants, on the contrary, are usually more or less ovoid, asymmetrical, and commonly highly irregular. Furthermore, they frequently form sporangia from their surface cells, as will be described below.

Our "glandless" and "glandular" varieties also differ

⁵ Ferns and Fern Allies of Missouri. Ann. Missouri Bot. Garden 20: 45-78.

⁶ A study of Tennessee ferns belonging to the genera Phegopteris, Polystichum, and Cystopteris. Journ. Tenn. Acad. Sci. 25 (no. 2): 101. *fig. d.* 1950.

⁷ Marvels of fern life. Nat. Geogr. Mag. 47 (no. 5): 547-562. May, 1925.

from each other in their bulblets: The bulblets of the Pennsylvania and Maryland representatives are practically naked, except for some hairs and small scales at their apices, and they appear to be much more irregular than those of our glandular variety (cf. *Pl. XII*, *b*, and *c*). All the bulblets of our glandular variety of the Great Lakes region tend to be heavily invested with dark scales when mature, so that their "cotyledons" are scarcely or not at all visible. In both of these varieties, there is a tendency for sporangium production to occur, especially around the sides and base of the proliferation, as shown by the arrows in *Pl. XII*.

Natural propagation via these proliferations probably occurs from time to time, although it must be very much less common than with the analogous structures of *C. bulbifera*. Dr. McGregor (in letter, Oct. 31, 1955) contributes the following notes:

"Mr. Weatherby had early asked me to look for bulblets forming sporophytes naturally. I have observed this twice. The first time was in Woodson County. Here a ledge had a row of perhaps 67 to 70 plants growing out from a crevice. The fronds hung down the side of the ledge. Just below was a small shelf. On this I found several bulblets. Some were just recently from the parents. Several were anchored and had a primary leaf about 2 cm. long. The second field observation was not so positive as the first. This time I was collecting gametophytes for class use. They occurred in large numbers at the base of a sandstone ledge. A small sporophyte was among them, and was growing from what I took to be a bulblet. The bulblet, however, was almost gone. From the ease with which these bulblets can be grown in the greenhouse, I do not see how they could fail outside."

In greenhouse culture, our specimens from Fayette, Delta County, Michigan, formed numerous small plants

from the bulblets, directly on the surface of the blade. A small plant has been grown from a bulblet from a Trout Lake, Chippewa County, specimen.

Under certain conditions of cultivation, the number of bulblets may be greatly increased, as was shown by a plant from Trout Lake, Michigan, grown at Birmingham out of doors in soil by Hagenah. Some of the fronds of this plant bore as many as 12 bulblets; two of these fronds are shown in the tracings in *Pl. XII*. Such a condition of supernumerary bulblets was likewise found in the glandless form by Wherry at Catoctin Furnace, Maryland, in September, 1953. McGregor finds that "*C. fragilis* var. *tennesseensis* produced bulblets much more abundantly on limestone than on sandstone. I have seen it on several different limestone ledges and observation revealed hundreds of bulblets. I have never seen such on sandstone-inhabiting plants."

Over a decade ago it was reported⁸ that the proliferations of these plants were peculiar in character, and the description of the bulblets of the colony of the glandless variety at Catoctin Furnace has proved to be typical of subsequent observations. The bulblets range from irregular masses 3 to 4 mm. in diameter, made up of several smaller masses (mainly leaf primordia) as shown in *Pl. XII*, down to smaller masses of vegetative tissue only 0.5 to 1.0 mm. in diameter, with some sporangeous tissue intermixed. And at the Catoctin Furnace locality, the latter extreme may also pass into an enlarged sorus just above a pinna base. It is these tiny proliferations especially which are overlooked in the field and in the herbarium, and for which collectors must be especially on the lookout.

In Shaver's description of the bulblets of *C. tennesseensis* he commented that "they seem to be similar to

⁸ Wagner, 1944, *op. cit.*, p. 126.

those of *C. bulbifera* in general structure and shape, in their location in leaflet axils, and in the possession of small white (or rarely brownish) lanceolate scales." His further comments suggest considerable irregularity:

"The very young bulblets are often club-shaped when viewed from the side and this is a very common shape for bulblets in *C. bulbifera*. In some cases these bulblets are flattened in one plane and they may even be expanded into a leaf-like appendage which may show veining. In one case a very small one had more scales—brown in this case—than usual and bore a cluster of sporangia among them."⁹

A small bulblet from a plant from Trout Lake, Michigan, is shown in *Pl. XII, b₁*, in which sporangia are borne along the sides among the scales.

During the years 1953–54, Mr. Joseph S. Krakow undertook to grow bulblets of the glandless variety from Catoctin Furnace, Maryland, in sterile culture; and he kindly provided us with the following notes: "The bulblets were sterilized in 10% chlorox for 15 minutes and were grown on 0.1% yeast extract plus White's Standard Medium.¹⁰ Of those put up in culture, approximately 70% became contaminated and were discarded. This left about 15 bottles of uncontaminated cultures. In those in which the bulblets were well formed at the time of excision, growth occurred with new crosiers being formed, but in no instance with the formation of roots. In those cultures inoculated with only a piece of the rachis containing what appeared to be a bulblet primordium, none grew. Of interest were the masses of prothallia which formed around the bases of the bulblets.

⁹ Shaver, J. M., 1950. A new fern, *Cystopteris tennesseensis* sp. nov., from Tennessee. *Journ. Tenn. Acad. Sci.* 25 (no. 2): 106–113.

¹⁰ White, P. R. 1943. A handbook of plant tissue culture. Lancaster, Pa. J. Cattell.

In a few cases, there appeared to be an inhibitory effect of the prothallia on the bulblet. In these instances the plantlet died, whereas the prothallia were going strong." In all probability the production of numerous prothallia around the bases of the bulblets was due to the presence of sporangia on the bulblets.

This last peculiarity is unquestionably the most remarkable feature of the "hybrid" varieties in the *Cystopteris fragilis* complex—a situation entirely unlike any other known species of fern that has been reported to our knowledge—that sporangia can be borne *not only in sori*, but *also along the rachis* at the bases of the pinnae, associated with the peculiar bulblets. Yet this condition, which seems so teratological, occurs as a more or less "normal" phenomenon in a large number of populations over a very wide geographical range. Collectors are urged to make further studies of these unique plants.

DEPARTMENT OF BOTANY, UNIVERSITY OF MICHIGAN,
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Tree-ferns in Western Mexico

C. V. MORTON

In Dr. William R. Maxon's account of the tree-ferns of Mexico¹ 23 species are listed and described—six of *Cyathea*, five of *Hemitelia*, nine of *Alsophila*, one of *Dicksonia*, and two of *Cibotium*. All of these species are reported only from Veracruz, Puebla, Oaxaca, Tabasco, or Chiapas, all located in eastern and southern Mexico.

There have been rumors of tree-ferns in western Mexico, but no definite information or specimens until rather recently. Two species may now be recorded definitely. *Alsophila bicrenata* (Liebm.) Fournier was collected by

¹ In P. C. Standley, *Trees and Shrubs of Mexico*, Contr. U. S. Nat. Herb. 23: 38–47. 1920.

George B. Hinton (his no. 14185) at Chilacoyote, in the District of Mina, State of Guerrero, on April 20, 1939. It was reported to be a tree 10 meters high by streams in dense mixed forests. It is common enough to have received a local name "Palo de la Vida," as reported by Hinton.

The species *Hemitelia costaricensis* (Klotzsch) Mettenius was also collected twice in western Mexico by Hinton, first at Pasión, District of Montes de Oca, State of Guerrero, October 12, 1937 (*Hinton* 10793), and secondly at Coahuayana, District of Coalcomán, State of Michoacán, January 2, 1942 (*Hinton* 16262). The three specimens mentioned above were identified by Dr. Maxon.

A recent collection of *H. costaricensis* extends the range far to the north and west. The ornithologist Dr. Allan R. Phillips sent a specimen that he found in the Arroyo de la Cordoncillera, a little south of Puerto Vallarta, in the northwestern part of the state of Jalisco, at an elevation of about 100 meters. The species here has the local name "Palmita de Tierra Fria."

These two species are rather similar in general appearance but differ in many essential ways. *Alsophila bicornata* has a tall trunk, 5-10 meters high when well developed. The scales of the crown are conspicuously bicolored, the central portion being deep castaneous or purplish-black. The stipe is strongly prickly. The hairs of the costae are long and abundant, and brown, bullate scales occur at the base of the costules. *Hemitelia costaricensis* is often a smaller plant, the trunk sometimes being only 60 cm. high, but it may attain 5 meters or more. The scales of the crown are more or less concolorous and pale brown. The stipe is, apparently, not at all prickly. The hairs of the costae are present but fewer and shorter, and bullate scales are lacking or nearly so. In addition, of course, the *Hemitelia* has an indusium—a hyaline scale on the proximal side of the sorus, not conspicuous but always to be found—whereas the *Alsophila*

has no indusia, not even rudimentary ones. It is likely that study in the field will show additional characters of habit and perhaps leaf-shape.

It is interesting that in Dr. Maxon's discussion of *Hemitelia costaricensis*² the statement occurs: "The original specimens, collected by Warscewicz (nos. 36 and 197) in 'Costa Rica and Veragua,' have the appearance of being decidedly xerophilous for a tree fern; and it is interesting to note that the Guatemalan specimens cited below are all from the drier, western part of that country and that the Santa Rosa specimens in particular, which in their lesser size perfectly match the original, are from a region which, in fact, may even be called semi-arid. Few tree ferns are able to exist in such surroundings." This suggests that the occurrence of this species in a region as relatively arid as Jalisco is not altogether unexpected.

New County Records for *Botrychium matricariaefolium* in Maryland and Delmarva

CLYDE F. REED

In Clausen's Monograph of the Ophioglossaceae (1938), the map (no. 16) showing the distribution of *Botrychium matricariaefolium* A. Braun in North America indicates a single locality in Maryland, which is given on page 87 as Towson, Baltimore County, where it was collected by C. E. Waters (G, NY, U). That this species was reported by Tidestrom (1905) from within four miles of Washington, D. C., is also noted in Clausen's Monograph. This species is not listed in Tatnall's Flora of Delaware and the Eastern Shore (1946), and to the best of my knowledge no specimens of this fern have been recorded from the Delmarva Peninsula in any of the three states. In the Ferns and Fern-allies of Maryland and Delaware, including the District of Columbia (1953),

² Contr. U. S. Nat. Herb. 17: 417. 1914.

the author indicated on map 2, page 40, several localities and counties where this species had been found in Maryland.

Most of the specimens from Maryland have been found in the Piedmont Region—in Baltimore, Howard, Carroll and Montgomery Counties. Specimens have also been found on the Inner Coastal Plain, that is, in southern Maryland, in Prince Georges and Anne Arundel Counties. These areas are immediately adjacent to the Piedmont Region. The Patuxent River flows from the Piedmont Region of Carroll and Frederick Counties through Prince Georges and Howard Counties and along the side Anne Arundel and Calvert Counties on to the Inner Coastal Plain. Such a drainage could account for this species being along this river near Marlboro, as well as for the 70 specimens found along West River in Anne Arundel County, as West River is just to the east of the Patuxent and their drainages are contiguous in that area.

It may be worth while to mention here the distribution of another Piedmont plant that reaches its southern limit in Maryland in the region of the tidewater Patuxent and West Rivers. This most critical species is the hemlock (*Tsuga canadensis*), which is found in the region about Battle Creek, in Calvert County, an estuary of the upper Patuxent River. This area is not too far from either the West River locality or the Marlboro locality where *B. matricariaefolium* has been found. As a matter of contrast, the cypress (*Taxodium distichum*) reaches its northern limit in southern Maryland in the upper tidewater Patuxent River region. Herpetologically the Patuxent River drainage is also a critical northern limit for *Hyla femoralis*¹ and *Microhyla carolinensis*.²

¹ Fowler & Orton, Maryland Journ. Nat. Hist. 17 (1): 6-7. 1947.

² Noble & Hassler, Copeia 1936 (1): 63-64.

The author has collected *B. matricariaefolium* in western Maryland in mossy pastures bordering hemlock forests on Savage Mountain, near Finzel, in Garrett County, at about 2950 ft. elevation. This was the first collection of this species in the Appalachian Region of Maryland. Several specimens were collected; their identification has been verified by Dr. R. T. Clausen. Since this species is found to the north of Maryland in such habitats, its occurrence here in western Maryland is not surprising.

While collecting and studying the flora of the Delmarva Peninsula the author has found many interesting and new species for that region, one of these species being *B. matricariaefolium*. In a forest just east of Silva, in Accomac County, Virginia, several plants of this species were found in 1955. Four specimens were collected, and there were several more. Within a few feet were numerous plants of *Ophioglossum vulgatum*, *Botrychium dissectum* f. *dissectum* and f. *obliquum* and *B. virginianum*. To the best of my knowledge these specimens from Silva, Virginia, are the first record of this fern on the Delmarva Peninsula. This woods in which *B. matricariaefolium* occurs contains many species of ferns and flowering plants which are otherwise considered Piedmont in their distribution; about 150 species are now on record and an annotated list is being published as "The Piedmont Flora of Coastal Delmarva." Notable Piedmont ferns in this area are *Dryopteris hexagonoptera*,³ *Osmunda claytoniana*,⁴ *Athyrium thelypteroides*,⁵ and *Ophioglossum vulgatum*.⁶ These species are known from other Piedmont areas on the Delmarva Coastal region.

The occurrence of *B. matricariaefolium* on Coastal soils is also known in New Jersey, west of the pine barrens, in

³ Reed, Clyde F. The Ferns and Fern-allies of Maryland and Delaware, including the District of Columbia, 157, map 34. 1953.

⁴ Reed, *op. cit.*, 59, map 9.

⁵ Reed, *op. cit.* 101, map 19.

⁶ Reed, *op. cit.* 37, map 1.

Burlington, Monmouth, Camden, Gloucester, and Salem Counties, along the estuaries of the Delaware River.⁷

The finding of *B. matricariaefolium* in the Silva woods extends the known distribution of this fern about 150 miles southward and 100 miles eastward from the New Jersey localities and the Inner Coastal Region of Maryland respectively. However, there seems to be no immediate geographic continuity with either of these areas. But the same may be said for the other 150 species found in the Silva woods. (Actually the Silva woods extend from Stockton and Boxiron in Worcester County, Maryland, to Modest Town and Atlantic, in Accomac County, Virginia.)

The following are the specimens forming the basis for the statements made in this paper.

APPALACHIAN REGION: GARRETT Co.: In mossy pastures 1 mi. east of Finzel, elev. 2950 ft., June 1, 1952, *Reed* 29320 (verified by R. T. Clausen).

PIEDMONT REGION: BALTIMORE Co.: Towson. *C. E. Waters* (G, NY, U); Towson, May 30, 1905, *C. C. Plitt* (*Reed* Herb.); moist woods in Baltimore Co., July 14, 1906, *C. C. Plitt*; rocky woods, Woodstock, April 7, 1941, *Reed* 4288. HOWARD Co.: Low ground, Ellicott City, *J. B. Egerton & C. E. Waters* (*Gray* Herb.); labelled *B. tenebrosum*, but probably a small *B. matricariaefolium*. MONTGOMERY Co.: Woodland near Bethesda, July, 1944, *G. R. Fessenden* (see *Wild Flower* 28: 21. 1952). CARROLL Co.: Damp woods about 6 mi. below Sykesville, along stream near Patapsco River, *W. H. Wagner, Jr.* (see *Amer. Fern Journ.* 31: 21. 1941).

INNER COASTAL PLAIN: PRINCE GEORGES Co.: Along Patuxent River near Marlboro, *W. H. Wagner, Jr.* (see *Amer. Fern Journ.* 31: 22. 1941). ANNE ARUNDEL Co.: Damp open woods, along West River, below Mayo, *W. H. Wagner, Jr.*, in 1939 and 1941 (70 small plants) (see *Amer. Fern Journ.* 31: 21. 1941).

OUTER COASTAL PLAIN: ACCOMAC Co., VIRGINIA: Woods in Piedmont area between Silva and Sinnickson, May 30, 1955, *Reed* 36617.

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⁷ Chrysler & Edwards, *The Ferns of New Jersey*, 23, map 2. 1947.

A New Name for an *Asplenium* Hybrid

C. V. MORTON

The Scott's Spleenwort, *Asplenium ebenoides*, was demonstrated long ago to be a cross between *A. platyneuron* and *Camptosorus rhizophyllus* by Miss Slosson.¹ Later, another cross, *A. cryptolepis* Fernald [*A. Rutamuraria* var. *cryptolepis* Wherry, as I prefer to call it] with *Camptosorus*, was described by Dr. E. Lucy Braun.

It has recently been rather conclusively demonstrated by Dr. Warren H. Wagner, Jr.,² that the well-known *Asplenium pinnatifidum* is a fertile tetraploid (allopolyploid) derived by the crossing of *Asplenium montanum* and *Camptosorus rhizophyllus*. This being so, it is quite likely that this crossing is taking place *de novo* occasionally, and that some plants of *A. pinnatifidum* found in the wild may be sterile diploid hybrids, the result of recent hybridization and not the descendants of pre-existing plants of *A. pinnatifidum*. A condition similar to this has been shown by Dr. Wagner to exist in *A. ebenoides*, for the Alabama population of this is a full-fledged "species," being a fertile tetraploid, whereas plants occurring elsewhere are newly formed, sterile diploid hybrids. Dr. Wagner has indicated that other *Aspleniums* also, such as *A. Trudellii*, *A. Gravesii*, and *A. kentuckiense*, have some *Camptosorus* "blood" in them, being crosses of *pinnatifidum*.

As I pointed out in my review of Wagner's paper,³ these facts point up a serious nomenclatural difficulty. The International Code of Botanical Nomenclature provides that intergeneric hybrids (if designated by more than a formula, i.e. *Asplenium platyneuron* × *Campto-*

¹ "The Origin of *Asplenium ebenoides*," Bull. Torr. Bot. Club 29: 487-495. 1902.

² "Reticulate Evolution in the Appalachian *Aspleniums*," Evolution 8: 103-118. fig. 1-8. 1954.

³ This JOURNAL, 45: 25, 26. 1955.

sorus rhizophyllus) be supplied with a generic name "usually formed by a euphonious combination of parts of the names of the two parent genera," and further that "The [specific] epithet of an intergeneric hybrid must not be placed under the name of either of the parent genera." (Appendix II, Art. H3). The example actually given in the Code is the Scott's Spleenwort, which should be called "*× Asplenosorus ebenoides*," and not "*Asplenium × ebenoides*." If this procedure were rigorously followed, it would mean that *pinnatifidum*, *Gravesii*, *Trudellii*, *kentuckiense*, the hybrid with *cryptolepis*, and any others that may be known in the future (e.g. the hybrids *A. Trichomanes × Camptosorus rhizophyllus*, or *A. resiliens × Camptosorus rhizophyllus*, which are not yet known, but which are certainly possibilities) would all have to be referred to a genus "*Asplenosorus*." Such a "genus" would be indefinable. Therefore, I suggested that it was better to revert to the old concept, and call the walking fern *Asplenium rhizophyllum* L. Actually, the genus *Camptosorus* is distinguished in any case by only tenuous characters, and not ones of fundamental importance, and might well be considered an *Asplenium* on purely taxonomic grounds. The attenuate, radicant apex is found in many species of *Asplenium*, and anastomosing veins (and the consequent irregularity of the sori) are found in other (unrelated) species, such as *A. Purdieanum* Hooker, of South America, which form the "genus" *Asplenidictyum* J. Smith.

Dr. Wherry proposed⁴ that hybrids between *Asplenium* and *Camptosorus* be called *× Asplenosorus* and he made the new combination *Asplenosorus ebenoides*. Although this name has been accepted in several fern books, it is

⁴ "A Hybrid-fern Name and Some New Combinations," This JOURNAL, 27: 56. 1937.

not validly published. According to the International Code (Art. 49) "For purposes of valid publication names in Latin form given to hybrids, including nothomorphs, are subject to the same rules as are those of non-hybrid taxa of corresponding rank." This means that hybrid genera must have descriptions, and also, after 1935, diagnoses in Latin. Wherry originally provided no description and no diagnosis in Latin. Later in 1937, Wherry⁵ did provide a description that might be considered as a combined generic and specific description of a new monotypic genus (inasmuch as *ebenoides* was the only species known at the time), and consequently valid as a description (Code, Art. 50), but still no Latin was provided, nor has a Latin diagnosis been published since. Consequently, *Asplenosorus* is invalid, and also any specific names published under *Asplenosorus* are invalid (Code, Art. 51).

The remarkable hybrid originally described merely by the formula *Asplenium cryptolepis* × *Camptosorus rhizophyllum* E. L. Braun was provided with a Latin diagnosis. Later, this plant was provided with a Latin specific epithet, as × *Asplenosorus inexpectatus* E. L. Braun ex Friesner, Butler Univ. Bot. Stud. 4: 154. 1940, but this epithet is invalid, since, as shown above, the genus *Asplenosorus* is invalid. The hybrid is therefore lacking a valid name. It seems fitting that Dr. Braun's name should continue to be associated with this plant, and therefore the following new name is proposed, with her kind permission.

Asplenium inexpectatum E. L. Braun, nom. nov.

Asplenium cryptolepis Fernald × *A.* [*Camptosorus*] *rhizophyllum* L., Amer. Fern. Journ. **29**: 133, pl. 10. 1939 (diagn.)

In this connection, it is of interest to point out that in England hybrids between *Asplenium* and *Phyllitis* are

⁵ "Guide to Eastern Ferns," 111. 1937.

known, and have been provided with the generic name *Asplenophyllitis*, which is validly published by Mr. A. H. G. Alston with a Latin diagnosis.⁶ These hybrids are between *Asplenium Trichomanes*, *A. obovatum*, and *A. Adiantum-nigrum* and *Phyllitis Scolopendrium*. This suggests that Copeland may be right in reducing *Phyllitis* to *Asplenium*, as he did in his *Genera Filicum*. Certainly, a close relationship between the genera is suggested. Still, these hybrids are excessively rare, and always sterile, which indicates perhaps that *Phyllitis* is farther removed from *Asplenium* than is *Camptosorus*.

Shorter Notes

LYCOPODIUM OBSCURUM VAR. DENDROIDEUM F. PROLIFERUM IN QUETICO-SUPERIOR WILDERNESS AREA, MINNESOTA.—*Lycopodium obscurum* var. *dendroideum* is a common clubmoss in northeastern Minnesota, where its extensive colonies dominate the ground cover of forested shores of many a wilderness lake. Excepting for minor variations in the size of strobili, the plants are uniform in growth habits and structural characteristics. Therefore, the finding of fruiting plants with apical tufts came as a surprise. The arresting novelties, some dozen individual plants, constituted a distinct group in a mossy hollow, amidst scattered colonies of var. *dendroideum*, under a coniferous cover in rocky terrain sloping into Basswood Lake. The plants, identified as *L. obscurum* L. var. *dendroideum* (Michx.) D. C. Eaton, f. *proliferum* Viet., are characterized by proliferation of the strobilus axis into a sterile leafy tip above the sporophylls. All the strobili of the plants observed were thus tufted. Occa-

⁶ "Notes on the Supposed Hybrids in the Genus *Asplenium* Found in Britain." Proc. Linn. Soc. London 1939-40, pt. 2: 139. 1940.



LYCOPodium OBSCURUM F. PROLIFERUM

sionally an anomalous appearing individual plant may be found in which the fertile strobilus is reduced to a few millimeters in length with a much prolonged sterile apex. This rarely encountered variant was discovered and collected (*Lakela* 19576), on Sept. 24, 1955, at the Quetico-Superior Wilderness Research Center, Basswood Lake, Lake Co. The strobili are well shown in the photograph by Clifford Ahlgren.

In studying herbarium materials, an earlier overlooked collection (*Lakela* 9501) made by the author was discovered among some 60 sheets of St. Louis County plants. A single plant of this collection, from granite ledges of Kabetogama Lake, has distinctly tufted strobili. The other plant on the same sheet is typical var. *dendroidum*. The Kabetogama Lake site is about 80 miles northwest of Basswood Lake, thus extending the range of f. *proliferum* along the Canadian border.—OLGA LAKELA, *University of Minnesota, Duluth Branch*.

HART'S-TONGUE IN MICHIGAN AGAIN.—In the last number of the Fern Journal Mr. Dale J. Hagenah reported the good news of the discovery of a large and flourishing colony of hart's-tongue in northern Michigan. We have just received the following letter from Mr. Hagenah:

"I must report that I have sad news about the stand. The area was lumbered over last winter although it was not clear cut. Apparently the company was interested only in the real prime timber. M. T. Hall and I were there this fall. We could still find quite a lot of hart's-tongue and in terrain which is not likely to be damaged by any further lumbering operations, as it is an area of huge boulders with only small timber. However, this area would be at most about one-fourth or less of the total. We do not feel that we can tell much about the remainder until next year, as the combination of timber cutting and a hot, dry summer made the area

look very sad, but we are hopeful since some of the Bruce Peninsula stands appear to have withstood severe conditions. The land was in private ownership, but we hear that the owners will sell after they complete lumbering, so it may be possible to find a way to get the fern area into suitable ownership, so that it can be protected from further damage. There is still a very large area which has not been botanized, and so there is still some possibility of other colonies being found."

Perhaps some conservation societies will interest themselves in the case?—C. V. MORTON.

Recent Fern Literature

"FERNS OF MALAYA,"¹ by Prof. R. E. Holttum is easily the most important book on ferns published in many years—the result of a lifetime of concentrated work and thought. There are about 500 species (and many additional varieties) of ferns in Malaya, about one-twentieth of all those of the world, a large percentage, considering the small size of the area. Apparently, this region of rainy tropical jungle and moist mountains provides the ideal situation for ferns, which if not exactly a dominant part of the vegetation are certainly an important component.

The specific descriptions are commendably long and detailed for a floristic work. Of course, most valuable of all is the fact that they are completely original and are not quoted from other sources, and thus include many new observations on morphology and relationships. The wonderful drawings are also wholly original, and are probably the work of Professor Holttum himself; there is no indication of assistance from a professional artist.

¹ In "A Revised Flora of Malaya," vol. II, pp. 1-643 *fig. 1-362. pl. 1-3.* 1954. For sale by the Botanic Gardens, Singapore. \$20.00, Malayan (\$6.00, U. S.).

The general classification follows Holttum's own system as he outlined it in 1949.² In this, the traditional family *Polypodiaceae* is divided into five—*Polypodiaceae sens. strict.* (which includes only the former subfamilies *Polypodioideae* and *Dipteridoideae*), *Grammitidaceae* (which includes only *Grammitis* and some closely allied genera that were formerly included within *Polypodium* itself), *Thelypteridaceae* (which includes only *Thelypteris* and some genera that may very well be included in *Thelypteris*, all of which were formerly included in *Dryopteris sens. lat.*), *Adiantaceae* (which includes *Adiantum*, *Ceratopteris*, and the subfamilies *Vittarioideae* and *Gymnogrammoideae*), and *Dennstaedtiaceae*, which includes all the rest. This expanded "Dennstaedtiaceae" is essentially formed by the union of Copeland's *Pteridaceae*, *Davalliaceae*, *Aspidiaceae*, *Aspleniaceae*, and *Blechnaceae*, and like Copeland's families is a *mélange*, completely indefinable. It is not without significance that no key to families is provided, nor that there is no characterization of the family *Dennstaedtiaceae* nor any description of it, although descriptions of describable families such as *Cyatheaceae*, *Hymenophyllaceae*, *Thelypteridaceae*, *Grammitidaceae*, and the others are provided as a matter of course. And it is to be regretted also that the name *Dennstaedtiaceae* was chosen. Holttum at no time has attempted to explain his choice of this name, probably for the good reason that it would be impossible to justify. Priority applies to family names just as much as to generic or specific, and *Dennstaedtiaceae* dates as a family only from 1940 whereas *Pteridaceae* or *Aspidiaceae* (and others) have priority of a hundred years or more. And this is certainly not the only instance in which the Code of Nomenclature is ignored.³

² Holttum, R. E. The Classification of Ferns. *Biol. Rev.* 24: 267-296. 1949.

Holttum's general approach is radical when it comes to the recognition of segregate genera and conservative in dealing with species, which is all right with me. After all, the discrimination of species is the important thing in everyday work in the herbarium and in the field. Genera are of more importance theoretically than practically. However, Holttum has been conservative in the Gleicheniaceae, in which only one genus is recognized, and I was pleased to find only the traditional *Hymenophyllum*¹ and *Trichomanes* in the Hymenophyllaceae. Exception ought to be taken though of the recognition of "*Ampelopteris*" as a genus distinct from *Cyclosorus* apparently solely on the basis of having proliferous buds, for we read on p. 299, "*Ampelopteris* is very distinct from *Cyclosorus* in its proliferous habit, and may conveniently rank as a separate genus; but of its close relationship to *Cyclosorus* I have no doubt." The presence of proliferous buds is a commonplace among ferns and surely not a character of generic significance or phylogenetic importance. One thinks immediately of *Asplenium enatum* of the Hawaiian Islands, a notably proliferous plant that is only doubtfully even specifically distinct from another species, and, of course, of the well-known *A. bulbiferum*. In American *Goniopteris*, which

³ For instance, the name *Ctenopteris*, an illegitimate name that Holttum proposed for conservation. It was considered by the International Committee on Nomenclature, and rejected. Nevertheless, Holttum refuses to abide by this decision and continues to use the name *Ctenopteris*, even reducing the prior genus *Prosaptia* to it, with the statement that this "arrangement seems to involve the minimum change under present circumstances." Actually, however, out of 13 species of "*Ctenopteris*," Holttum found it necessary to make nine new combinations in the Flora of Malaya; adoption of the name *Prosaptia* would have involved exactly the same amount of change, namely nine new combinations, and these would have had at least a chance of permanency, which those under *Ctenopteris* do not.

⁴ An extremely minor error was noted in the discussion of *Hymenophyllum* on p. 75, paragraph 4. *Meringium* has the segments toothed and *Mecodium* entire and not *vice versa*; this is obviously purely a slip.

is closely allied to *Cyclosorus*, some species have buds and others do not; and the same holds true in *Polystichum*, in *Cystopteris* (*C. bulbifera*!), and many other genera.

However, matters of technical nomenclature are not of importance at all in judging the value of the Ferns of Malaya, which is truly a landmark in fern books for which I have the deepest admiration. Considering the scope of the work, it is impossible to comment on the details, much as I should like to do so. The fact that Holttum knows so many of these ferns in the field adds immeasurably to the authenticity of the treatment. Every fern student must have this work for himself. He will find himself constantly consulting it, for its usability is by no means confined to the limited area of Malaya. Many of the genera discussed, and many species too, are widely distributed throughout the world; and many are known in cultivation also. And so, my advice about the book is—buy it!—C. V. MORTON.

“FIELD GUIDE TO FERNS AND THEIR RELATED FAMILIES,”¹ is a curiously unbalanced book. The drawings by Mrs. Foster are among the best ever published, beautifully designed and accurately executed. On the other hand, the text by Mr. Cobb is one of the worst, being replete with blunders of all sorts. The area treated is stated (p. xvi) to be “that territory lying east of the 88th longitude, north of the 47th latitude, and south of the 36th latitude, and west of the Atlantic Ocean,” although the intention is obviously south of the 47th and north of the 36th parallel. This area includes from Wisconsin south to Kentucky and eastward to the Atlantic Ocean. The nomenclature employed is that of the New Britton and Brown Illustrated Flora, but regrettably the different names used in the eighth edition of

¹ By Boughton Cobb, with illustrations by Laura Louise Foster. Published as one of the Peterson Field Guide Series, by Houghton Mifflin Company, Boston, Mass. pp. 1-281. 1956. \$3.75.

Gray's Manual are not added, so that sometimes users of the latter work may have difficulty in figuring out which species is which.

The first 35 pages are devoted to a series of illustrated keys; the key characters are rather poorly selected and crudely stated. The individual species, which apparently are arranged in no sort of order (*Woodwardia* between *Onoclea* and *Polystichum*, *Woodsia* between *Adiantum* and *Cheilanthes*), each have a page of text devoted to them, including paragraphs describing the aspect (curiously termed "Style"), one on Ecology (which includes some unclear statements of geographic range), one on Leaves (adopted instead of the well-nigh universally accepted term fronds), in which the alleged dimensions are stated in inches, followed by the symbol for plus-or-minus.² The data given are grossly misleading, often twice the average size of the species; to mention but one example, a beginner will never find a Walking Fern if he looks for a fern with leaves 12 inches long and 1 inch wide. The next heading, "Leaflets," refers either to pinnae or (erroneously) to lobes or segments; and smaller divisions are clumsily termed "subleaflets," not a word that will be found in any dictionary. Axis is used for either rachis or midrib, stalk for the stipe.³ The descriptions of Rootstocks and Roots do not agree well with the accurate illustrations; and the roots are too often said to be black, this being the color of the humus

² The criticism implied here by Professor Wherry is a valid but subtle one. The symbol $\pm$ is used in statistics to give maximum and minimum deviations (*e.g.* 700 ± 20 , *i.e.* 680 to 720) has been adopted in fields other than mathematics to mean "about" or "more or less"; it must *precede* its object, *i.e.* ± 6 inches, means about 6 inches. When Mr. Cobb writes (p. 74) concerning the leaflets of Crested Fern "Cut into $6 \pm$ blunt-pointed subleaflets" he is actually saying "more or less blunt-pointed," whereas what he means is "about six." [Ed.]

³ And sometimes "stem" (correctly the rootstock or rhizome) is used for either stipe or rachis, and we can read, for instance, "where over-all leaf is simple that part of stem contained by leaf's surface is called the Midrib, the name also applied to central stems contained by leaflets, subleaflets, and lobes." (p. 1). [Ed.]

that stains their surface. The old term "Fruitdots" is revived for "sori," even though it is not really appropriate or descriptive for sori that are not dots but lines.

The following will illustrate some of the errors: The fertile leaves of the Ostrich Fern are lute-shaped, not "lyre-shaped" (p. 6); the form of the frond of the Maidenhair Fern is certainly not "whorled" (it might perhaps be described as a double-scroll) (p. 12); the Oak Fern is described as having a "kidney-shaped" indusium, but actually it has no indusium at all (p. 32); in the Stiff Clubmoss (*L. annotinum*) the cones are stemless and not "short-stemmed" (p. 35); in Narrow-leaved Spleenwort, the leaflets are uncut and not "once-cut" (which would mean that they were pinnatifid or pinnate) (p. 53); the leaves of Woodsias are rarely, not "usually" evergreen (p. 58); in Marginal Woodfern (*Dryopteris marginalis*) the edges of the "subleaflets" (i.e. segments) are merely undulate, and not "serrated or lobed" (p. 64); the Virginia Chain Fern grows in sunny, not "shady" locations (p. 124); in the common polypody the leaves are not "lustrous golden color" above, but are green, and the fruit-dots (sori) are not "red-brown" but yellow (p. 130); the leaves of Rusty Woodsia are green above and not "dark brown" (p. 146); the "stalk" (i.e. stipe) of Hartford Fern (*Lygodium*) is unbranched, not "sinuous and branching," which evidently has reference to the rachis; in fact, the whole description of the Climbing Fern shows a misunderstanding of its structure; the rachises grow intertwined and so may give the casual impression of having "branches and forks, unlike other ferns," but of course they are actually unbranched (p. 162); the spores of Royal Fern do have, and not "lack," chlorophyll, and they ripen in early, not "late," summer (p. 168); in the Water Clover (*Marsilea*), the "leaflets" (i.e. pinnae) are said to be composed of "4 wedge-shaped petals," but actually it is the leaves, not the "leaflets," that are com-

posed of 4 wedge-shaped segments (or pinnae, or leaflets, but not "petals") (p. 178); the Leathery Grape Fern (*Botrychium multifidum*) is said to have a number of "variable forms, depending on their ecology, and integrating 'embarrassingly,'" by which is intended intergrading⁴ (p. 190); in the Rattlesnake Fern, the sporophylls are borne in the spring, and not in "midsummer" (p. 192); in contrasting the archegonia of *Equisetum* with those of the true ferns, those of the latter are said to "grow from the top of the prothallus," whereas they actually grow on the bottom surface (p. 196); the branches of *Equisetum palustre* are said to form "a flat-topped inverted triangle," but a triangle is a plane figure and "cone" would be more appropriate (p. 210); *E. litorale* is considered to be a hybrid of *E. fluviatile*, and not *E. palustre*, as stated (p. 212); the spores of clubmosses are said to be "semi-kidney-shaped," which would seem to mean shaped like half of a kidney, but actually they are round, and the gametophytes of clubmosses are the largest known, and not "minute" (p. 215); [*Lycopodium*] *porophilum* does not mean "split-leaved," but "crevice-loving"⁵ (p. 217); the leaves of Bog Clubmoss (*L. inundatum*) are not "1¼" inch long, but are more nearly ¼ inch (p. 224); the quadrangular fertile tips of the stems of *Selaginella* are not "sporophylls," but cones or strobili (p. 234); the publisher of the Manual of Pteridology is Frans Verdoorn, not "Father Verdoorn" (p. 263).

Infelicities in the text could be listed indefinitely.⁶

⁴ And at the bottom of p. 53 we find the meaningless statement regarding the lady-ferns: "The integration of the varieties in the middle grounds make them almost impossible to classify properly." [Ed]

⁵ Literally, a lover of "pores," i.e. of porous rock. [Ed.]

⁶ Some of those that I might point out in addition to those selected by Prof. Wherry for mention are: The strange paragraph at the bottom of p. 44, "Practically all pteridophytes are perennial plants. Certainly all species dealt with in this handbook are perennial; one exception is the British annual gymnogam, *Annogramma* [sic] *leptophylla*, a delicate little fern found only in the Channel

Such is the use of the word "style," defined on page three as "the quality of form," for what is normally termed habit. The enlarged drawings are said to have been "arranged as symphonic margins" (p. 3). The rootstock of Ebony Spleenwort is said to be both "creeping" and "erect," which are antithetical terms (p. 90). The drawing *fig. d* on page 91 is said to represent a "Vegetation budding leaflet" growing from an old stalk, [of *Asplenium platyneuron*] var. *proliferum* (p. 90).⁷ The fruit-dots [by which in this case is meant indusia] of *Asplenium Ruta-muraria* are said to be "on veins near and opening toward outer segments of outside segments of subleaflet," whatever that means (p. 100). The "leaflets" [pinnae] of Silvery Spleenwort are said to be cut into "semi-subleaflets," which could only mean "half pinules"; "segments" is intended (p. 112). The leaves of Bulblet Fern are first described as being 8 inches long,

Islands"; strange because *Anogramma leptophylla* is not dealt with in this handbook, because of the invented word "gymnogram," which I presume is intended to indicate a fern belonging to the subfamily Gymnogrammoideae, and because of the restriction of this species to the Channel Islands, although in reality it is one of the truly cosmopolitan ferns, occurring in all continents. Exception can be taken to the erroneous statement (p. 46) regarding *Schizaea*: "Curly Grass is very rare, or found at present only in one locality." After remarking about the discovery of *Asplenium Adiantum-nigrum* in Colorado, Mr. Cobb says that it seems probable that the spores were transported by air currents from Asia to Colorado, and continues "Similarly, there are now first reports for *Asplenium septentrionale* in our western mountain area, as well as for *Ceterach officinarum* in our Southwest. Are the atomic test explosions in the Southwest sending us spores of our southwestern species and perhaps of these Asiatic immigrants?" It seems as though the atomic age is being blamed for too much; *A. septentrionale* is surely a native, being not a recent immigrant but an old relict; this circumboreal species, although uncommon, is widespread in the western states; it was collected in Colorado by the Hayden Expedition in 1869, and probably even before that by other early Government expeditions to the west. The reference to *Ceterach officinarum* in the Southwest seems to be imagination only. [Ed.]

⁷ The drawing actually shows, not a "leaflet," but a young plant growing from a proliferating bud on the stipe, which is probably impossible; so far as known, the buds on Ebony Spleenwort (which are extremely rare, rather than "not uncommon," as Cobb has it) are always borne on the rachis at the base of the pinnae, and not on the stipe. [Ed.]

and in the same paragraph are said to often reach 36 inches in length and known to reach as much as five feet (p. 156). The rootstock of Bulblet Fern is said to be "slightly horizontal" (p. 156). The spores of *Equisetum* are said on germination to "throw off their other coats and change from round hard bodies to the dorsiventral (spreading or lobed) soft prothalli, male or female."⁸ The stems of *Equisetum scirpoides* are said to have "3 broad ridges, deeply concave, give a ridge appearance"; what other appearance can ridges give? (p. 198). The stems of *Selaginella apoda* are described as "spreading alternately" (p. 236).

To illustrate how badly some individual species fare, the Netted Chain Fern (*Woodwardia areolata*) (p. 122) may be selected.⁹ This is said to "sometimes grow in semi-brackish waters," but it is a plant growing in acid humus and would soon die in such an environment; it is the other species, the Virginia Chain Fern, that can withstand brackish conditions. The Netted Chain Fern is said to be "rare," but it is rare only in the north and common southeastward. Its sterile blades are said to be cut into "pairs of nearly opposite leaflets," but these are in fact alternate, one of the best obvious distinctions

⁸ Aside from the patent absurdity of the above statement, it might be pointed out that "dorsiventral" does not mean "spreading or lobed." [Ed.]

⁹ My own choice for the worst treatment would be that of the Oak Fern (p. 78). It is certain that Mr. Cobb has completely misunderstood the architecture of the frond (which is of a normal pinnate type) and conceives of it as being composed of three pinnae (which he would term leaflets), two lateral and one terminal. It is only thus that one can comprehend (barely) what is meant by "The central, or upper, leaflet broad-triangular; stem, $\frac{3}{4}$ " long, is that part of stalk between the two jointed stems of lower leaflets and its own lowest pair of subleaflets." This can be interpreted to mean that the distance between the two lowest pairs of pinnae is $\frac{3}{4}$ inch. (Mr. Cobb must have had a somewhat depauperate specimen in hand.) The whole leaf of the Oak Fern is said to be about five inches "tall," but the subleaflets (i.e. pinnules) are said to be about eight inches long, an anomaly that I am unable to interpret. [Ed.]

from the sensitive Fern being missed here.¹⁰ As usual, the leaf dimensions are exaggerated. The fertile leaves are contracted throughout the season and not only "when mature"; their lobes are normally flat, and not "re-curved." They do not have "sausage-shaped rows of chainlike fruitdots," but the reverse; and these rows lie close to the midrib, and not halfway to the margin (correctly shown in the drawing).

But why go on? For there are scores of blunders such as those enumerated above. In a work intended for amateurs extra care should have been taken to have the information accurate; folks who are so misguided as to rely on the present book are going to have to unlearn a lot later on. The text can only be classed as a disgrace to the Peterson series of Field Guides, and a serious setback to fern study by the amateur.¹¹—EDGAR T. WHERRY.

In "LOS HELECHOS (PTERIDOFITOS) DE CHILE CENTRAL" our Honorary Member Dr. Gualterio Looser has provided a useful treatment of the pteridophytes of central Chile (the Provinces of O'Higgins, Colchagua, Valparaíso, Santiago, Aconcagua, and most of Coquimbo). The genera treated will almost all be familiar to fern stu-

¹⁰ They are correctly shown as alternate in the drawing. [Ed.]

¹¹ I must reluctantly concur with Professor Wherry's evaluation of this work. It is one thing to write for the amateur and quite another to write amateurishly; the expression of difficult concepts in simple language requires literary skill as well as a scientific background, both conspicuously lacking in the present instance. The well-written chapter "Ferns in the Flower Garden," by H. Lincoln Foster, is in welcome contrast to the rest of the book. It is perhaps unnecessary to go into the shortcomings of this book at such length; still, because of the auspices under which it is published, it is apt to be received with an undue amount of enthusiasm in some quarters. In fairness to Mr. Cobb, it should be pointed out that he gives credit to a professional botanist, Dr. Svenson, for "checking and correcting" the manuscript. And in justice to Dr. Svenson, I might guess that he, being a busy man, conceived his function to be the pointing out of the obvious errors rather than the complete rewriting that the text patently needed. [C. V. Morton, Ed.]

¹ *Moliniana* 1: 5-95. *figs. 1-31*. 1955.

dents of the United States; some of them show affinities especially with the western states in such species as *Pellaea ternifolia* (common to both, although rare in the United States), *P. myrtillifolia* (very like *P. andromedifolia*), *Adiantum chilense* (much like the Californian *A. Jordani*), *Cryptogramma fumariifolia* (extremely similar to *C. acrostichoides*), *Blechnum Gayanum* (not unlike *B. spicant*), *Dryopteris argentina* (similar to *D. nevadensis*), *Polystichum mohrioides* (near or identical with western American plants), *Ophioglossum lusitanicum* subsp. *coriaceum* in Chile, subsp. *californicum* in California), and species of *Notholaena* and *Cheilanthes* suggesting west-American types. This close relationship between the Chilean and Californian floras has been known for a long time, and is, of course, not confined to the pteridophytes. The flora of Chile also shows affinities with that of New Zealand, another well-known alliance; this is shown among the ferns here treated by such species as *Hypolepis rugosula* (typically in New Zealand and represented in Chile by var. *Poeppigii*), *Pteris chilensis* (quite like the New Zealand *P. tremula*), *Blechnum chilense* (in New Zealand, the allied *B. "procerum"*), *Asplenium obliquum* (typical in New Zealand, var. *sphenoides* in Chile), and especially by the remarkable *Pleurosorus papaverifolius*. *Pleurosorus* will be unknown to most readers, for the very good reason that it is one of the rarest fern genera, having only three species, all excessively rare, one in Chile, one in New Zealand, and one in Morocco and southern Spain. The only other genera treated are all wide-spread and well known (*Cystopteris*, *Dennstaedtia*, *Polypodium*, *Equisetum*, *Azolla*, *Pilularia*). Dr. Looser is to be congratulated on his thoroughly scientific and accurate presentation, which includes descriptions, synonymy, citation of specimens, and notes on ecology, popular uses, and cultivation. It is to be noted that ferns are still in general use in folk

medicine in Chile, some, such as *Polypodium Feuillei*, apparently being considered almost as a panacea. Some Chilean ferns are in cultivation locally (Looser mentions particularly *Dryopteris argentina*, *Dennstaedtia glauca*, *Blechnum auriculatum*, *B. chilense*, and *Cheilanthes glauca*), but apparently only two have been cultivated in Europe and the United States—*Adiantum sulphureum* and *A. excisum*—both of which must be exceedingly uncommon at the present time, if indeed they have not dropped out of cultivation altogether. Because of the similarity in climate, it is likely that many Chilean ferns could be grown successfully out-of-doors in California; two species would seem to be particularly suitable subjects for experimentation, because they are both large and handsome plants—*Blechnum chilense* and *Pteris chilensis*. Here is tempting ground for some of our new Los Angeles members to explore. All they need now is a source of supply.—C. V. MORTON.

“Tree Ferns,” by our new member Walter H. Hodge,¹ is a small pamphlet giving a brief popular account of the tree-ferns. It is notable for several fine photographs of trees in their natural habitat and in cultivation. It is available to Fern Society members at cost (25 cents).—C. V. MORTON.

American Fern Society

CHAUNCEY JACKSON NEWELL, “UNDISTINGUISHED” FERN LOVER.—It is a commonplace observation that newspapers take special note only of people who have done some particularly outstanding thing—creditable or discreditable. However, it is also recognized that the welfare of the country at large depends finally on

¹ Longwood Favorites No. 2, pp. 1–10. 1956. Published by Longwood Gardens, Kennett Square, Pennsylvania.

the behavior of the general run of the citizenry, even though the activities of these "common men" are not specially newsworthy. This note calls attention to an "undistinguished" representative of the Fern Society, who has owned and operated a grist mill and saw mill in Alstead, New Hampshire, since 1902. In that same year, he was married, and also became a member of the Fern Society. During the past fifty-four years, his name has probably not appeared in the pages of the Fern Society publications five times. He has never written anything for publication; "I almost did, once," he told Dr. B. R. Allison, a summer neighbor who provided the data for this note.

Mr. Newell's first interest in ferns began when, as a boy in Parrishville, New York, his birthplace, he tried and liked eating fern fiddleheads as greens. There, his first business venture was a grist mill. Later, he became a surveyor and his experiences in running lines cross-country, through woods and over mountains, stimulated his interest in nature. At the age of 92, he is still ready to show a friend a fern locality. On a recent visit of Dr. Allison's, Mr. Newell asked, "Have you seen the ferns in the pothole?" Instead of giving directions, Dr. Allison reports, "He proceeded to lead me through the woods to a peculiar rock formation up a near-by brook where fragile fern and several other kinds grew."—R. C. BENEDICT.

SUSAN H. THURSTON:—Through the death of Susan H. Thurston (Mrs. Edward D. Thurston, Jr.), last summer, the American Fern Society lost a member who had contributed significantly toward the study of ferns as garden plants, and also to the Fern Society. In 1938, Mrs. Thurston and her husband, working as a team, staged an exhibit of 60 native ferns at the annual International Flower Show in New York. This exhibit, pre-

sented under the auspices of the Millbrook Garden Club, had been preceded the year before by a similar smaller exhibit in Millbrook, New York. The preparation of such an exhibit, involving the collection of adequate material and the experimental determination of the times needed for forcing dormant plants into full leafage, had required extensive testing and record keeping.

Later, Mrs. Thurston contributed a precise report of the experiences and procedures of the forcing operation to the *Fern Journal*.¹ The article included a large folded chart which gave in detail the schedules of development required by various species. Through the generosity of the Thurstons, this article was reprinted as a special Fern Society bulletin of information for distribution to new members and other interested people. Included with it were two articles on raising ferns from spores.²

A few years later, the Thurstons developed a fern garden at their home in Sharon, Connecticut. The site picked, a sunny acre of pasture, was made suitable for ferns by a shading cover of timber and lath, with borders of bushy hemlock as windbreaks. Under the lath shade, grading and a hidden water supply provided a realistic brooklet and a setting appropriate to different fern species. Massive blocks of limestone, and other rock material furnished successful sites for rock-loving species. The completed result was an unusually successful home for a large number of different ferns, not a few of which thrived to an extent rarely equalled even in the best natural habitats. The making of the garden and its final lay-out were described by Mr. Thurston in a well-illustrated article.³ The Thurstons were always hospitable to visitors and the Fern Society had a memorable meeting there in 1952.—R. C. BENEDICT.

¹ This JOURN. 28: 85-94. 1938.

² R. C. Benedict, This JOURN. 29: 95-98. 1939, and Edson, J. & Griffeth, G., This JOURN. 29: 98-101. 1939.

³ This JOURN. 32: 41-57. 1942.

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American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the
AMERICAN FERN SOCIETY

EDITORS

C. V. MORTON
R. C. BENEDICT IRA L. WIGGINS
A. C. SMITH

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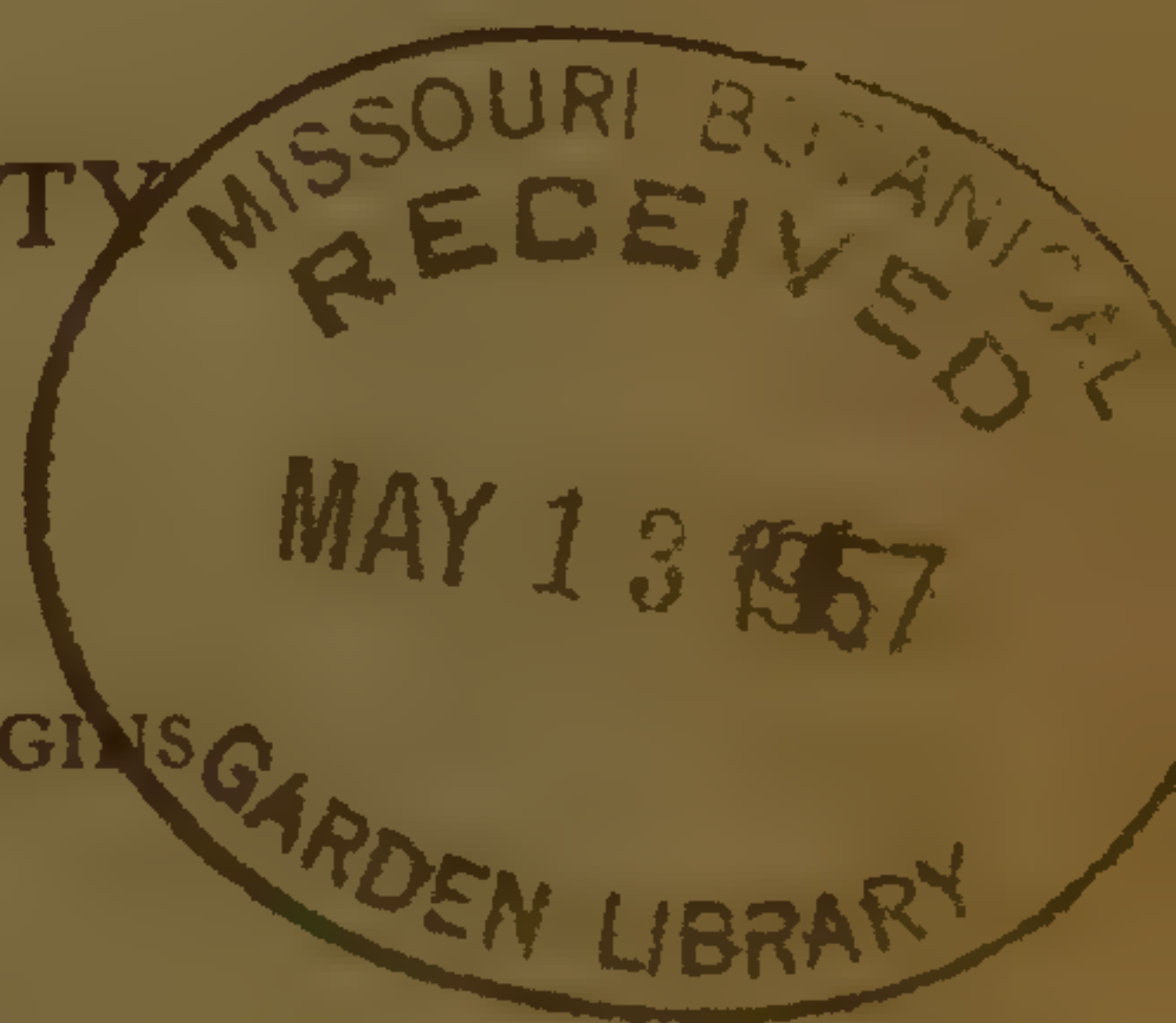
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American Fern Journal

VOL. 47

JANUARY-MARCH, 1957

No. 1

The Vegetable Lamb of Tartary¹

ALICE F. TRYON

“In the land of Tartary toward high Inde and Bach-arye in the country of the Grand Can there groweth a manner of plant that is strange and wonderful indeed. This, which they call Barometz, meaning the lamb, grows from the earth in the likeness of a real lamb having head, eyes, feet and is attached at the navel to a root or stem. Its covering is an exceedingly soft wool. In height it is half a cubit and according to those who tell of this wondrous thing its taste is agreeable and its blood is sweet. It lives as long as there is herbage within reach of the stem to which it is tethered and from which it derives its life.”

The story of this curious fable reveals something of man's views toward natural phenomena and of the puzzles that arise in sorting fact from fancy as the tale is embellished. It is not possible to discover the origin but the story of the Vegetable Lamb, or Barometz, is described in one of our earliest written records, the Talmudical books. Rabbi Jochanan “in the year of salvation 436” tells of this plant-animal having the form of a lamb and attached like a gourd to the soil. It is reported as coming from the works of another personage on the authority of still another. Thus the description

¹ Originally published in the Missouri Botanical Garden Bulletin, vol. 43, no. 2 (1955). Because this Bulletin is not available to many Fern Society members, and because of its general interest, this article is reprinted here by courtesy of Mrs. Tryon. [Ed.]

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appears to have been told time and time again before it entered the written record. In 1235 a commentator wrote that this creature is the Jedoui mentioned in the Scriptures, and that witchcraft is practiced with its bones. No creature can approach within the tether for it will devour them, but arrows carefully aimed will rupture the stem whereupon the animal dies. The legend was brought to England by Sir John Mandeville, something of an English Ulysses who journeyed far and wide and returned after 34 years to record his adventures. In the fair country of Caldilhe there grows a melon-like fruit within which is a little beast "in Flesche, in Bon and Blode, as though it were a lytylle Lomb with outen Wolle." At this same time a similar report came from Italy. Odoricus, a Minorite friar, traveled out of Padua among the Tartars of the East and tells of gourds in which are found little lamb-like beasts growing in the mountains of Capsius, in the province of Kalor. One of the early accounts of plant curiosities, *Histoire Admirable des Plantes*, by Claude Duret, has a chapter on these zoophytes that live as plants but are sensitive like animals, existing in Tartary—a place filled with heavy and dense air.

By the 16th and 17th centuries the story reached the academic circles and the doctors and professors began their speculations, arguments, and investigations. Kircher, a mathematics professor at Avignon, argued that it was a plant in spite of its quadruped form. Girolamo Cardana of Pavia discussed the impossibility of the phenomenon, contending that if it had blood it must have a heart and that the soil could not supply the heart with

PLATE I. From *Histoire Admirable des Plantes*, by Claude Duret, 1605. "Of all the strange and marvellous trees, shrubs, and herbs which Nature, or rather, God himself, has produced, or ever will produce in this Universe, there will never be seen anything so worthy of admiration and contemplation as these Barometz of Seythie or Tartarie, plants which are also animals, and which browze and eat as quadrupeds."

Philos Trans N° 390

Agrostis hyemalis vegetabilis.
Barometz dictus.

ex
Musio Breyniano.

Illustration from a Latin treatise titled "Dissertumcula de Agno Vegetabili Seythico, Barometz vulgo dicto" written in 1725 by Dr. Breyn of Danzig. Independently of the English botanists he arrived at the conclusion that the Barometz was made from the stem of a fern. Dr. Breyn with the characteristic precision and serious point of view of the Prussian scientist lamented the influence of the quaint and human influences in the realm of Natural History. He advised all those who search for the hidden treasures of Nature to bear in mind the axiom that the works and productions of Nature should be discovered, not invented.

the proper movement or warmth. Dr. Kaempfer, a surgeon to the Dutch East India Company, journeyed to Persia in search of the creature. Although he found nothing but ordinary sheep, he observed the custom of taking unborn lambs for their softer fur and he considered that these might be the source of the legend.

At last a specimen was found. In the pomp and splendor of the Royal Society of London, the celebrated physician and botanist Sir Hans Sloane laid the object before the scientific world. It was about a foot long, having a body covered with dark, yellowish hair much as a lamb. The Vegetable Lamb of Tartary, the Barometz, was identified as a portion of a fern plant that grows in southern China. The fern specimen exhibited by Sir Hans Sloane was much like the one in the accompanying photograph recently sent to the Missouri Botanical Garden from Formosa.

These are extraordinary ferns, not small woods or rock plants but trees reaching the height of 15 feet, belonging to the genus *Cibotium*. The species of the lamb is appropriately named *C. Barometz*; it bears a cluster of handsomely cut fronds growing to a height of 14 feet and the large stem, which does not develop into a trunk, is covered with long, tawny hairs. In China these silken hairs are placed on wounds to stop the flow of blood. The floss of other Pacific species is called *Pulu* and has been used to stuff cushions and mattresses. *Cibotium Barometz* is native to southeast Asia and in southern China and Formosa the lambs are prepared. A portion of the stem with several fronds is removed and the latter are cut leaving only the stubs to serve as appendages. The eyes, made of seeds of *Duranta repens*, a plant of the Vervain family, are affixed and the mouth is embroidered.

The appeal of the legend was not lost after the scientific explanation was presented for it was enshrined in

the verse of Erasmus Darwin. This Darwin was a physician and a keen student of nature who believed that changes in evolution were due to internal desire—a theory quite unlike that proposed by his famous grandson Charles. He was a philosopher and poet as well, and in his fanciful verse titled *The Botanic Garden* he perpetuated the legend of the lamb:

Cradled in snow, and fanned by Arctic air,
Shines, gentle Barometz, thy golden hair;
Rooted in earth, each cloven hoof descends,
And round and round her flexile neck she bends.
Crops the gray coral moss and hoary thyme,
Or laps with rosy tongue the melting rime;
Eyes with mute tenderness her distant dam,
And seems to bleat—a “vegetable lamb.”



Vegetable Lambs made in Formosa from fern stems

Ding Hou, our Chinese student studying at the Missouri Botanical Garden Herbarium, relates that the fern, *Cibotium Barometz*, is common in north and central For-

mosa. There the country folk gather the stems, add the essential parts and fix the face preparing the lambs for the city market. They are usually sold near the temples, and he has seen some twenty vendors each having a dozen or more of the "animals" along a roadside near the Buddhist temple on a mountain south of Formosa's capital city, Taipei. The locality is selected not for any religious implications but rather because this is a likely place to sell the lambs to tourists who have come from the China mainland to visit the temples.

By the end of the 19th century the influence of Sir Hans Sloane's explanation had lessened and the legend was re-examined by another Englishman, Henry Lee. With the object of reporting the history of cotton he reviewed the story of the vegetable lamb in a delightful little book titled *The Vegetable Lamb of Tartary, a Curious Fable of the Cotton Plant*. He claims the legend for cotton with arguments based on philologic, geographic and botanical evidence. The prepared fern rhizomes are relegated to toys made in the image of a small rufous dog. His arguments seem sound but perhaps it was too late to dispel the confusion between the two, and the fern long having the name Barometz is to this day called the Vegetable Lamb.

Observations on Cultivated Ferns. I

C. V. MORTON

It is with some trepidation that I start a series of papers on cultivated ferns. My interest in ferns is of long standing, but my experience has been largely with the wild species, especially those of the United States and tropical America. Cultivated ferns present some different problems. Still, there is a widespread and growing interest in cultivated ferns, or perhaps I should say

more accurately in cultivating ferns, and the contributions that I shall make may be helpful.

The contributions mentioned above will be along strictly botanical lines. Horticultural guidance will have to be left to others more expert. Unfortunately, I do not have a greenhouse available, and my personal experience in cultivating ferns is thus extremely limited. And I shall have to leave the "Ohs" and "Ahs" to others too, which is not to say that I lack appreciation of the beauty of ferns. Far from it! Still, I must confess that, like many botanists, I prefer the symmetry and grace of a specimen of a well-grown wild or "botanical" fern to a moth-eaten-looking cut-leaved form of a European Lady Fern or an unnaturally skeletonized Male Fern.

I shall begin with one of the difficult groups—the genus *Pteris*, although this genus is not essentially difficult if one deals only with the "botanical" species. An investigation into the origin and characteristics of the numerous horticultural varieties would lead me too far astray, although I shall be glad to receive communications regarding them.

KEY TO THE CULTIVATED SPECIES OF *PTERIS*

Veins uniting (Section *Litobrochia*).

Pinnae simple and unlobed, except the basal two-parted pair. *P. denticulata*

Pinnae all pinnatifid, the basal pair very large, compound, once- or twice-forked *P. tripartita*

Veins all free (Section *Pteris*).

Pinnae all simple, not lobed or pinnatifid *P. vittata*

Pinnae, or at least the lower ones, pinnatifid, lobed, or variously forked.

Middle and upper pinnae all regularly pinnatifid, with many pairs of segments.

Basal pair of pinnae once-forked; segments rounded.

P. quadriaurita

Basal pair of pinnae bipinnate; segments acute or acuminate.

Segments mostly fertile to near the apex, bluntly toothed.

P. tremula

Segments mostly fertile only in the lower half, sharply toothed *P. arguta*

Middle and upper pinnae simple, or sometimes with a few large lobes but not regularly pinnatifid.

Blade apex elongate, pinnatifid. Pinnae strongly asymmetrical, deeply pinnatifid on the lower side only, with several segments *P. semipinnata*

Blade terminating more or less abruptly in a terminal pinna similar in general to the other pinnae.

Rachis essentially unwinged to near the apex, the lower two pairs (of pinnae) stalked, the lower three or four pairs lobed; sterile segments much broader than the fertile, mostly rounded or obtuse . . . *P. ensiformis*

Rhachis generally winged upwardly, or sometimes to the base, most of the pinnae sessile or adnate, only the lowermost sometimes a little stalked, mostly only the lowermost pinnae lobed; sterile segments long-attenuate at apex.

Sterile blades rather thickish in texture, cartilaginous-margined and sharply toothed; segments mostly 1 cm. broad or more; pinnae shorter-decurrent, usually the lower part of the rhachis unwinged.

P. cretica

Sterile blades thinnish in texture, not cartilaginous-margined, toothed but not sharply so; segments various; pinnae strongly decurrent, the rhachis normally winged between the two lower pairs of pinnae.

Stipe mostly slender, less than 2 mm. in diameter, 25 cm. long or less; pinnae narrow, mostly less than 1 cm. broad *P. multifida*

Stipe stout, mostly 2.5–3 mm. in diameter, mostly 40 cm. long or more; pinnae large, mostly more than 1 cm broad *P. umbrosa*

PTERIS CRETICA L. The Cretan Brake is one of the most widely distributed of all ferns, being almost pantropic. It is also one of the commonest ferns in cultivation, especially some of the horticultural variants. The form with the leaves white-striped along the midveins is cultivar. *albolineata*; it is illustrated in Bailey's

Standard Cyclopedia of Horticulture, as is also one of the crested forms, cultivar. *Wilsonii*. Some of the dissected forms go under the names *Wimsettii*, *Drinkwateri*, and *Childsii*. In the literature, *Pteris Ouvrardii* (a horticultural rather than botanical species) is said to be a form of *multifida*, but the specimens that I have seen under this name are *cretica*, and pretty typical *cretica* at that.

PTERIS DENTATA Forskal. The Toothed Brake¹ is common in cultivation. I have received specimens recently from Mrs. Fay MacFadden and Dr. W. C. Drummond. Apparently in the trade it is more commonly grown under the later synonymous name *Pteris flabellata*, and it has appeared also in cultivation under other synonyms, such as *Pteris elegans* and *P. luxuriosa*. It is very much like *P. tremula* in general.

PTERIS DENTICULATA Swartz. This species, a native chiefly of Brazil, shows a habital resemblance to *P. cretica*, being similar in coloration, texture, and general form but obviously different in its areolate (anastomosing) venation. It is probably very rare in cultivation.

PTERIS ENSIFORMIS Burmann. The Sword Brake, common in cultivation, is a native of Asia. In old lists it appeared under the synonymous name *Pteris crenata*, and may sometimes still be so listed. A form with white banded pinnae is cultivar. *Victoriae*, often listed as *Pteris Victoriae*. It is not known in the wild.

¹ The common names adopted are those used in "Standardized Plant Names" by Maxon, Weatherby, and Morton (1942). They were mostly "invented" by us to fulfill a need of American horticulturists, especially the American Association of Nurserymen, the Ornamental Growers' Association, and the Society of American Florists and Ornamental Horticulturists. However, there is nothing official about them, and no one is obliged to use them if he does not wish to, in contrast to Latin names, which do have a certain standing and may not be changed without adequate reasons.

PTERIS MULTIFIDA Poiret. The common name applied to this species—Spider Brake—is a well-known name rather than an invented one, doubtless applied because of the elongate slender divisions (“spider legs”) of the blade. In the trade this is probably always known as *Pteris serrulata* L. f., which is an older, but illegitimate, name for the same plant. Even commoner than the species in cultivation are the numerous named monstrosities; most of these are crested forms, which can be known collectively as cultivar. *cristata*.

PTERIS QUADRIAURITA Retzius. So far as I know, this species has never received a “common” name; perhaps a translation of the Latin name “Four-eared Brake” might at least be unusual and easily remembered, even if somewhat obscure in meaning. The four “ears” are presumably the four divisions of the lowest pair of pinnae, each of which is forked. The species itself is not common in cultivation; Mrs. MacFadden has had it in her lathhouse in Los Angeles for the last 18 years, but she does not recall her source of supply. Much more common is the Striped Brake, which is cultivar. *argy-raea*; it is exactly like the typical form of the species except for the white stripes along the pinnae, which render it more ornamental in the opinion of some.

PTERIS SEMIPINNATA L. This species, a native of Asia, has a distinctive form—the pinnae are as though they had been cut in half, for they are strongly lobed on the basal side and entire on the upper side. It is probably rare in cultivation, or perhaps restricted to botanical gardens.

PTERIS TREMULA Robert Brown. The Australian Brake is the commonest species in cultivation, being widely available in small pots in ten-cent stores throughout the

country, which probably indicates that it is easily propagated. However, to reach its maximum size and beauty it needs other conditions than those available in the ordinary house, where it is apt to be too hot and dry. Dobbie calls it the "Shaking Brake," a name undoubtedly suggested by the Latin name, the application of which is somewhat obscure. In New Zealand it grows to a height of four or five feet, but is not long-lived.

PTERIS TRIPARTITA Swartz. This, one of the largest and most beautiful species of ferns, can be grown out-of-doors only in warm regions, and perhaps in the United States only in Florida. A native of the Old World tropics, it was probably first introduced into cultivation by the Royal Palm Nurseries, Oneco, Florida. From a letter on file in the U. S. National Museum dated December 30, 1935, from Mr. J. A. Combs, the manager of the Royal Palm Nurseries at the time, it appears that this species was first listed in the catalogs in 1896, where it appeared, without specific name as a large sort reaching a height of 6 feet, forming a magnificent specimen; it was said to have been introduced from Hawaii, but probably it was only from cultivation, for it is not native in the Hawaiian Islands. From 1902 on, it was listed in the catalog as *Pteris marginata*, a synonymous name, until 1915, when it appeared as *Pteris tripartita*. The species escaped from cultivation in Florida, and by 1928 was common in various places, especially near Pompano, sometimes in localities quite remote from settlements. In general appearance, this species is similar to the tropical American *P. podophylla* Swartz, which may also be expected to appear in cultivation; the two are both decom-pound ferns, with very large lowermost pinnae, which are usually nearly as large as the rest of the frond, and which are repeatedly forked somewhat after the manner of *Adiantum pedatum*. In the

Royal Palm Nurseries, the original plant grew very large and was highly fertile; the method of propagation was merely to pick out the young sporelings, which came up throughout the greenhouses, often several hundred yards from the parent plant. The original plant was lost sometime around 1930.

PTERIS UMBROSA Robert Brown. The Forest Brake is a native of Australia. It has been in cultivation, but it may not be any longer. It is like a very large *Pteris multifida* in its general appearance, and in technical characters too.

PTERIS VITTATA L. The Chinese Brake is rather coarse and not very ornamental. It usually passes among gardeners and nurserymen as *Pteris longifolia* L., an allied species formerly confused with it.² The true *P. longifolia*, a native of tropical America is probably not in cultivation, although it is to be expected. It differs from *vittata* in having the pinnae jointed (inconspicu-

² As an instance of a confusion of the two in scientific literature may be mentioned a paper by John R. Jackson "Syngamy in *Pteris longifolia*" (Amer. Journ. Bot. 23: 162. 1936); voucher specimens deposited in the National Herbarium show that the plant actually investigated was *Pteris vittata* rather than *Pteris longifolia*. Incidentally, this case is evidence, if that is needed, of the desirability of preserving voucher material in a large herbarium of plants used in morphological, cytological, or other investigations. A most unfortunate example of the failure to do this is the paper "Apospory in *Pteris sulcata* L.," by W. N. Steil (Bot. Gaz. 67: 469-482. 1919). There is no such species as *Pteris sulcata* L.; there is an obscure species *P. sulcata* Meyen ex J. Smith, a synonym of *P. flava*, but this is certainly not the species investigated. It is a rare plant not known in cultivation. The material used in the study came from three sources—The New York Botanical Garden, the greenhouses of Marquette University, and from spores sent by Dr. E. B. Copeland from the Philippine Islands. In 1949, I wrote to Professor Steil asking about the identity of the material, and he replied that no voucher specimens were retained and that the material could not now be identified. Thus this study, even though it could make some contribution to our knowledge of apospory, is essentially valueless, since the material being studied is unknown.

ously) to the rhachis, and in having them spreading horizontally (rather than ascending at an angle), more closely spaced, more numerous, generally narrower, and more irregularly and not so finely toothed. The Chinese Brake is easily distinguished from all other cultivated species by its entirely simple pinnae, none of them being at all pinnatifid or lobed. Although it is a native of the Old World, it is now rather widely escaped from cultivation in the New World, and is well established in Florida, Alabama, and Louisiana, and it has been found casually as far north as Washington, D. C., where it does not persist.

Plastic Greenhouses

R. C. BENEDICT

For the people who may have wished at times for a small greenhouse to extend their plant growing, the introduction of small, reasonably priced plastic units, as described below, may be the answer. The initial cost and the maintenance seem likely to be much lower than for similar-sized glass houses. Various magazines, including *Life*, have recently carried stories of a small greenhouse, made of a polyethylene plastic. From circulars and correspondence, the following data have been derived:

After some years of testing and after plastic houses of larger size had been proved commercially practicable, a company, Plastic Greenhouses Inc.¹ has placed on the market two small units for home use. Both are seven feet high, the smaller covering 6' × 8' of ground space, the larger 12' × 16'. They are shipped as pre-cut kits, with complete instructions for erection, at \$89.95 and \$129.95 respectively. In the circular, it is noted that

¹ 520 Fifth Ave., New York 38, N. Y.



A PLASTIC GREENHOUSE

these list prices will be cut 10%, on an introductory basis, "on any orders of two or more units obtained through your organization"—in this case, the American Fern Society.

These plastic greenhouses are stated to have been developed with Dr. Emmert of the University of Kentucky as consultant. Several accessories are available at moderate cost including a precut supply of additional plastic by which a double surface can be obtained with the consequent advantage of an air space insulation, and heating units (a simple oil burner at \$10.00, or thermostatically controlled propane gas burners at \$40.00 and \$60.00). For further information, enquiries should be addressed to the company.

2214 BEVERLY ROAD, BROOKLYN, NEW YORK.

The Ferns and Fern-Allies at Chandler Lake, Alaska

IRA L. WIGGINS

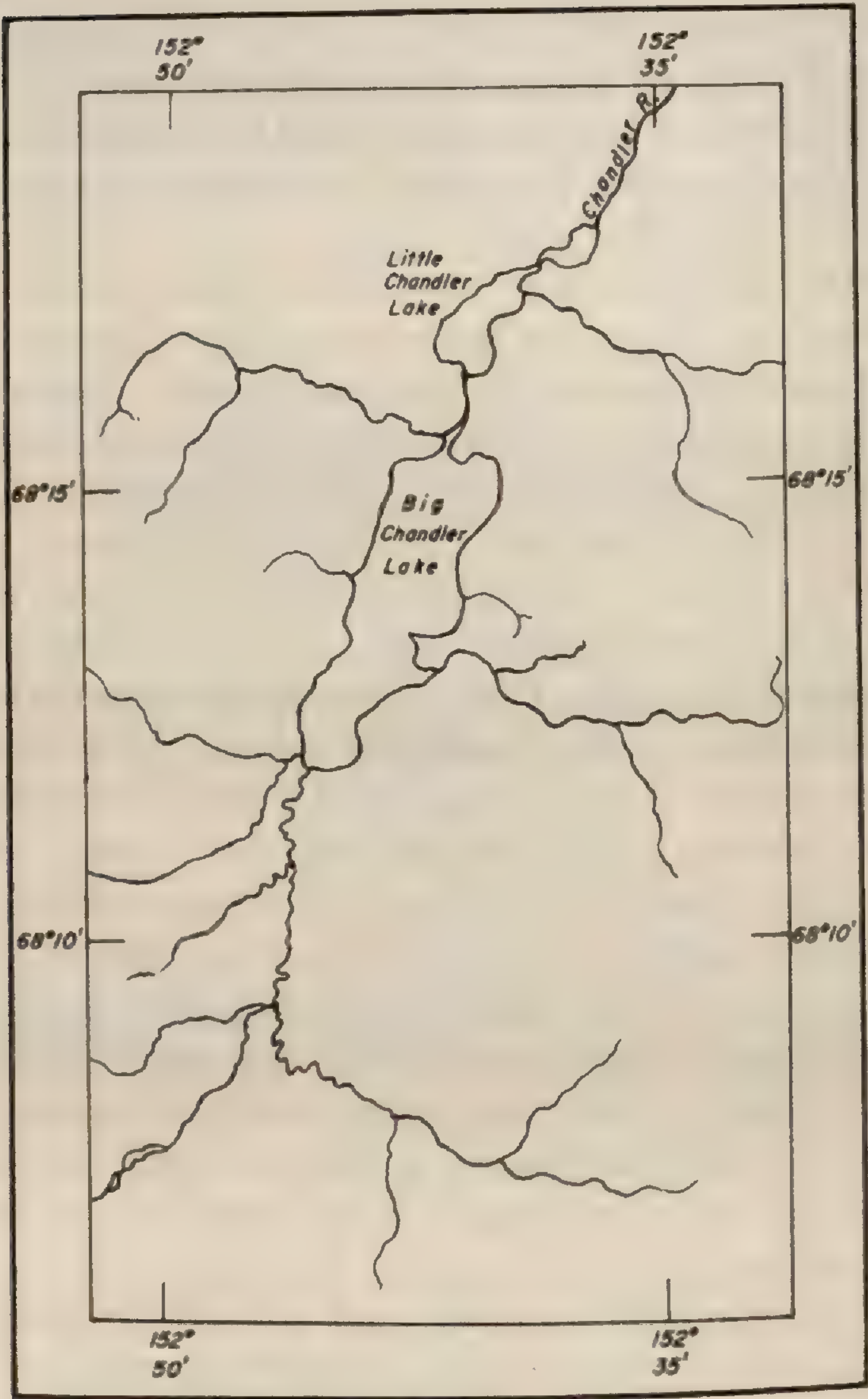
"Chandler Lake" is actually a series of one large and several small lakes, but only the large one, sometimes called "Big Chandler Lake," is here under consideration, and in this account the term "Chandler Lake" applies only to this one, the most southern of the series.

Chandler Lake occupies a narrow valley running north-northeast and south-southwest through the Brooks Range a little over half way between Fairbanks and Point Barrow. The lake is from one-half to nearly one mile wide and just slightly under five miles long. It drains northeast through the Chandler River into the Colville River about ninety miles away, and eventually into the Beaufort Sea of the Arctic Ocean. A number of small, rushing streams drop from adjacent mountains into the lake; the accompanying map shows the main outlines of the drainage in the near vicinity of the lake. At the

south end of Chandler Lake the floor of the valley broadens to nearly twice the width of the lake, and rises almost imperceptibly to the divide that separates the arctic drainage from that of the waters flowing into the Yukon River and thence into Norton Sound. The surface of Chandler Lake is about 2,900 feet above sea level, but mountain peaks rise steeply from its shores to heights of over 7,300 feet above the sea.

Extensive talus slopes and dark, mucky soil separate the shoreline from the more precipitous flanks of the neighboring peaks, and it is on this fringe of moderately sloping material that most of the vegetation around the lake occurs. About midway between the northern and southern ends of the lake a stream enters from the east through a slightly meandering channel cutting across a flat delta that extends a little over one-fourth of the way across the lake. This delta and the steeply sloping talus abutting on the toes of the nearest peaks support a dense carpet of typical tundra vegetation, consisting of grasses, sedges, a few prostrate willows, mosses, lichens, and an assortment of perennial herbaceous forbs. The soil of these habitats, which contains considerable peaty matter, is nearly or wholly saturated with water from melting snow, summer rains, and the run-off from the mountainsides during the summer growing season. In August or early September it freezes solid. Numerous small rills and shallow pools and ponds occur in the flatter areas.

The margins of the pools, and often the entire area of the small, shallower ones, support growths of such semi-aquatic species as *Carex aquatilis*, *C. lugens*, *Eriophorum angustifolium*, *E. vagans*, *Arctophila fulva*, and *Ranunculus pallasii*. Several other sedges and several forbs occur sporadically in these habitats. The wet soil adjacent, and the wet slopes too steep to permit formation of pools, support attractive arrays of arctic



DRAINAGE OF BIG CHANDLER LAKE, ALASKA

flowering plants and extensive colonies of *Equisetum arvense*. Among these flowering plants are *Papaver radicatum*, *Saxifraga cernua*, *S. foliolosa*, *S. rivularis*, *Ranunculus nivalis*, *R. lapponica*, *Lagotis glauca*, *Valeriana capitata*, *Cardamine richardsonii*, *Parrya nudicaulis*, *Polemonium boreale*, *Dryas integrifolia*, *Cassiope tetragona*, *Chrysosplenium wrightii*, *Corydalis pauciflora*, *Aconitum delphinifolium* var. *paradoxum*, four or five caryophylls, and several species of *Pedicularis*. Half a dozen grasses are well represented.

The northern shore of the delta is subjected to terrific pressure from the ice during break-up when northerly winds are of frequent occurrence. As a result a ridge of sand, gravel and churned tundra peat rises to a height of from three to twelve feet above the level of the lake and has a base varying from six to thirty feet or more in width. The high content of gravel and sand provides excellent drainage, so the substrata are relatively dry during most of the growing season. Along the landward side grow a number of species that would be incapable of surviving the water-logged conditions on the flatter, wet delta adjacent. The distances separating these plants on the well-drained soil from the ones with their roots almost constantly in water often is no more than a few decimeters. Among the species confined to the drier habitats are *Saxifraga bronchialis* var. *funstonii*, *S. tricuspidata*, *S. oppositifolia*, *Epilobium latifolium*, *Smelowskia calycina* var. *media*, *Myosotis alpestris*, *Androsace septentrionalis*, *Lupinus arcticus*, two species of *Oxytropis*, *Erysimum pallasii*, and two species of *Arnica*. At least two species of *Poa*, *Arctagrostis latifolia*, and an interesting *Hierchloë* also occur along the lower margin of the ridge.

Shallow ravines on the sides of the adjacent peaks contain fairly dense stands of Dwarf Birch, whose stems are usually procumbent and rarely rise more than a foot

above the soil. Intermingled with the birch are occasional patches of *Vaccinium vitis-idaea*, *Cassiope tetragona*, and several perennial herbs. Annuals seem to be wholly lacking. Mosses and lichens are abundant on all substrata except those undergoing active movement or erosion. Ferns and fern-allies are present in small numbers, but are not conspicuous, and with the exception of *Equisetum arvense* are rare in the vicinity.

During the summer of 1955 Mr. Donald G. MacVicar, Jr., while studying the geology of the area, collected the more abundant species of flowering plants and three pteridophytes around the shores of Chandler Lake. It was his intention to study the association of the plants with the various geological formations and types of terrain on which he was concentrating his attention. In 1956 he returned to Chandler Lake, accompanied by three other young men, to complete the field work in geology on which he hoped to base his dissertation leading to the Ph.D. degree at Yale University. The party landed on the ice of the still frozen lake on May 30th, made their camp on the delta mentioned above, and carried on field operations until July 20th. During the evening of that day Don MacVicar and one of his assistants, Mike Holdaway, had their boat swamped while crossing the lake in a squall and Donald MacVicar was drowned.

As the one in charge of the Arctic Research Laboratory at Point Barrow, it was my duty to supervise operations at Chandler Lake while attempts were made to recover the body of the drowned man. Consequently, from July 22 through August 8 occasional opportunities to make hurried collections were afforded me when high winds made operations on the lake impossible. In making such collections I found five genera of pteridophytes, each represented by a single species, growing in the near vicinity of the camp on the delta. Since few reports on

the flora of arctic meadows in the Brooks Range have been published it seems desirable to present some brief notes on the immediate habitats occupied by these ferns and close relatives.

CYSTOPTERIS FRAGILIS (L.) Bernh.

A small, delicate specimen of this species grew in crevices in a rocky, north-facing wall of a narrow gulch heading back into the main mountain on the eastern side of the lake and about one-half mile north of the delta. I collected it there on July 26, 1956, at an altitude of about 3,100 feet above sea level. Mr. MacVicar had found the species at two localities in 1955, neither one of which was precisely indicated in his meager notes. He did indicate, however, that in each instance he found the fern on soil, not on rocks, one plant on an alluvial outwash fan, and one on a steeply sloping solifluction sheet, both sites facing in a southerly direction. All specimens of *C. fragilis* seen in the vicinity of Chandler Lake, whether on soil or in rock crevices, were small as compared with plants of this species from more southerly stations. The fronds in our collections varied from 2.5 to 8 cm. in height. Sori were few and scattered, appearing on the larger fronds only. The indusia were strongly hooded and moderately fimbriate to nearly entire along the free edge, but no sporangia were mature so it was impossible to check spores to ascertain whether this might be *C. dickieana*. The rocks where *C. fragilis* was found in 1956 contained appreciable amounts of calcium carbonate, and Mr. MacVicar thought this compound was "probably present" in the soil of the outwash fan where he found the plant in 1955.

Specimens examined: Near north end of Chandler Lake, *MacVicar s. n.*, June 6, 1955; on rock walls of small gulch leading eastward from Chandler Lake, about one-half mile north of delta, alt. *ca.* 3,100 feet, July 26, 1956,

Wiggins 13773.

DRYOPTERIS FRAGRANS (L.) Schott.

This fern occurs abundantly among the boulders and slabs of shale on a moderately steep slope facing southwest and situated along the easterly shore of Chandler Lake, immediately north of the canyon leading to Anaktuvuk Pass. A tuft of the fern was noticed first under a slight overhang formed by a ledge of shale and partially shaded by a low bush of *Betula exilis* var. *nana*, at an elevation of 3,150 feet. Additional plants were found scattered along the shallow "chute" at least 300 feet farther up the mountain side. The plants were remarkably compact, with as many as fifteen to twenty fronds in a tuft, the pinnules so closely crowded that they were virtually imbricate. The upper surfaces of the leaves were dark green, the lower sides abundantly clothed with thin, pale-castaneous to grayish scales and masses of rufous-brown sporangia. The fronds were 8 to 15 cm. tall.

Although most of the spores had been expelled from the ripe sporangia, a tangled mixture of open sporangia, scales, and an occasional spore was sent to Mrs. Boydston. She reported that a fine lot of prothallia was obtained from the sowing she made on culture plates. Her success in obtaining prothallia was unexpected, for the plant press in which the specimens were dried was placed over artificial heat at the Arctic Research Laboratory for nearly twenty-four hours before the spores were removed to be sent to Mrs. Boydston. Similar treatment had been lethal to spores of *Polystichum munitum* collected in the Coast Range of California several years ago.

Dryopteris fragrans was not seen by MacVicar, or at least it did not appear in his collections nor did he mention it in his field notes. It is represented from the

Chandler Lake area by Wiggins 13805.¹

EQUISETUM ARVENSE L.

This is by far the commonest and most abundant pteridophyte in the Alaskan arctic, ranging over many different substrata and extending from well up in the Brooks Range completely across the foothill and tundra to the vicinity of Point Barrow, at Lat. 71° 20' N. In the Chandler Lake area it occurs on marshy flats, on water-soaked alluvial fans, on solifluction sheets and slumps, on stabilized talus slopes, and on old morainal mounds and ridges. It frequently is a "pioneer" on relatively bare expanses where slides have occurred and along margins of streams and lakes where ice and water action partially denude a bank or deposit heavy burdens of silt and sand. At the south end of Chandler Lake, *E. arvense* occurs sparsely on the sandy beach along the contact zone between the turf of the tundra and the wave-worked material of the shore.

Many of the branches arising from the shallow rhizomes and ascending rootstocks are decumbent, 1–1.8 mm. in diameter, and from 1 to 10 cm. tall. The ridges are often only three or four in number on the stems, and the

¹ James W. Bee and J. Knox Jones, Jr., camped on the shore of Chandler Lake, about three hundred yards from the site occupied by MacVicar in 1956, from August 9 to 25, 1951. They were under the supervision of Dr. E. Raymond Hall, of the University of Kansas, on a contract with the Office of Naval Research to make a survey of the mammals of the arctic slope of the Brooks Range. During the sojourn at Chandler Lake, Bee took several pictures that were reproduced in a book published in 1956 by the University of Kansas under the title "Mammals of Northern Alaska," by James W. Bee and E. Raymond Hall. Three of the photographs depict the general topography and some of the vegetation of the area. *Plate 2, fig. 1*, shows the broad, nearly flat valley at the southern end of Chandler Lake and about one-sixth of the surface of the Lake. *Plate 1, fig. 2*, shows grasses and other vegetation along a ledge where a singing vole (a small field mouse) had built a nest of willow leaves, and *Plate 3, fig. 1*, depicts two plants of *Dryopteris fragrans*. Unfortunately, Mr. Bee did not indicate the precise locality at which this photograph was taken.

internal canals are very small. The fruiting branches are few and often widely separated. In this northern material the strobili are only 3–5 mm. long.

At Chandler Lake, *E. arvense* grows most frequently on south-facing slopes, but occasionally it faces west, east, or north-west. It is always, apparently, on wet soil, but seems to grow equally well on substrata with and without lime in detectable quantities.

Specimens examined: At an elevation of 3,400 feet near the north end of Chandler Lake, June 21, 1955, *MacVicar s. n.*; mountainside east of delta, alt. 3,200 feet, July 27, 1956, *Wiggins* 13809.

LYCOPodium SELAGO L. var. APPRESSUM Desv.

This club-moss occurs among rocks on a partially stabilized talus slope along the easterly side of Chandler Lake. It was seen on slopes facing southwest and northwest, and probably grows at a number of spots around the lake. It was found as a scarce element in the plant cover just below the mouth of the small canyon in which *Cystopteris fragilis* grew, at an elevation of 3,100 feet. It is more plentiful, but hardly abundant, on both sides of the larger canyon leading easterly toward Anaktuvuk Pass from near the mid-point on the eastern shore of the lake. In this vicinity it extends upward from about 3,100 feet to at least 3,500 feet above sea level, always along partially stabilized talus slopes or about rocks in the bottoms of narrow, shallow "chutes," where melt-water and rains keep the rocks wet most of the growing season. The fruiting plants are usually bright green, but scattered ones may be rusty red. The stems are from 2 to 10 cm. tall, and almost rigidly erect. Fruiting strobili were present on most of the plants seen in late July and early August of 1956. *MacVicar* apparently did not collect the plant. It is represented from the Chandler Lake area by two collections, July 26, 1956,

Wiggins 13785, and July 29, 1956, Wiggins 13850.

SELAGINELLA SIBIRICA (Milde) Hieron.

This species occurs in scattered patches, mostly on the southerly sides of boulders and slabs of shale on the southwestern flank of a peak immediately east of the lake and north of the canyon through which the trail leads to Anaktuvuk Pass. Some of the colonies were several centimeters in diameter; others consisted of not more than three or four ascending stems. The habit of the plant resembles roughly that of *S. bigelovii*, but the branches are more robust and with fewer holdfasts than are displayed by the latter species.

The smaller patches were found in close association with vigorous colonies of *Dryopteris fragrans* along a "chute" where a small slide had occurred. The slabs and irregular blocks of shale and limestone in the immediate vicinity were fairly well stabilized, heavily encrusted with lichens and mosses, and often fringed by the semi-prostrate shrubs of the Dwarf Birch. Higher on the mountainside, the plants of *Selaginella* occurred on top of boulders as well as under protective overhanging slabs and ledges. A few colonies grew in small pockets of soil entrapped between rocks, but most of them were on rocky substrata. Fruiting branches were present in the material, but not abundant.

Specimens examined: At the above localities, July 27, 1956, Wiggins 13815.

STANFORD UNIVERSITY, CALIFORNIA.

Shorter Notes

A FURTHER NOTE ON CYSTOPTERIS.—In the last number of the Journal (p. 142), we described the bulblets of *Cystopteris bulbifera* when mature as "usually almost entirely naked, with a shiny epidermis." Since writing the above, two specimens from the Gray Herbarium collection were detected that do show scales on the bulb-

lets, these however pale-brown to nearly colorless, in contrast to the chestnut-brown ones of the "hybrids," and relatively much less numerous. These specimens of *C. bulbifera* were collected by J. J. Carter in Lancaster County, Pennsylvania, June 19, 1886.—W. H. WAGNER, JR. and DALE J. HAGENAH.

DRYOPTERIS IN GERMAN HORTICULTURE.—No. 82 of a German serial entitled Grundlagen und Fortschritte im Garten- und Weinbau (Principles and advances in horticulture and viniculture) comprises an alphabetical list of the genera found useful in outdoor gardening in Germany, from B to Dr. This was written by Wilhelm Schacht, of the Munich Botanical Garden, and contains concise but informative discussions of over 100 genera of ferns and flowering plants. His account of *Dryopteris* proved so interesting that a review of it is here published.

The common name assigned is Nierenfarn, which means Kidney Fern, manifestly connected with the once popular genus epithet *Nephrodium*. Although Christensen is followed in taking up *Dryopteris* instead, it is pointed out that many horticulturists use other generic names. The species list starts with *D. cristata*, recommended for wet, boggy soils; then comes *D. decursive-pinnata*, an east-Asian fern little known in America.

For *D. filix-mas* is given the common name Wurmfarne (Worm Fern), a designation new to me, the origin of which is mysterious.¹ It grows up to 1.2 meters (4 feet) tall, and a dozen of its variations are briefly treated. In German gardens our American *D. goldiana* reaches a height of over 1.5 meters (5 feet). *D. hirtipes* from tropical Asia has proved winter-hardy. *D. linnaeana* is termed in Germany, as here, the Oak Fern. The American *D. noveboracensis* there "loves a very moist, indeed

¹ It is presumably connected with the use of the Male-fern as an anthelmintic, a usage that it has maintained perhaps up to the present time. [Ed.]

marshy habitat." *D. phegopteris*, Beech Fern, favors a porous, humus-rich soil, and *D. rigida* from central Europe a rocky, limy situation.

Two common names are given for *D. robertiana*—Storksbill or Ruprecht Fern—the significance of neither being manifest²; a lime-loving shade plant, it is said to be easily grown, especially in the rock garden, which alas is not the case in America. *D. spinulosa* is termed Dornfarn (Thorn Fern); a "var. *glandulosa*" of it presumably represents either *D. dilatata* or *D. intermedia*. Last comes *D. thelypteris*, as aggressive in Germany as here—"It may become a nuisance by its spreading all around, and soon makes dense stands."—EDGAR T. WHERRY.

WHAT IS THE PRESENT STATUS OF OUR CLIMBING FERN?—The Climbing Fern (*Lygodium palmatum*) was formerly rather abundant in many localities, so much so near Hartford, Connecticut, that it received the common name of "Hartford Fern." In an article in *Rhodora*¹ I recently pointed out that it is no longer to be found in Hartford nor in many other places in New England where it formerly grew. Although it has been protected by law in Connecticut since 1869, highways² and the ad-

² These names are explained by Hegi (*Flora der Mittel-Europa*). In Germany, Herb Robert (*Geranium Robertianum*) has received the name (although it is scarcely a true popular name) of "Ruprechtskraut," i.e. "Ruprecht's Herb." It is also called "Storchschnabel," which is a sort of generic common name for all species of *Geranium*, given because of the shape of the fruit, just as the corresponding name "stork's-bill" is given to *Geranium* in English. Because of the similarity of the leaves of *Dryopteris Robertiana* to those of Herb Robert, this fern has received the "common names" of "Ruprechtsfarn" (i.e. Ruprecht's fern) and "Storchschnabelfarn," (i.e. stork's-bill fern). [Ed.]

¹ "Lygodium palmatum vs. Urbanization," *Rhodora* 58: 270, 271. 1956.

² In my article in *Rhodora* I blamed the Connecticut State Highway Department for having destroyed a station of the fern by spraying with weed-killer along a roadside. I have since learned that the spraying was carried out by a utility company.

vance of real estate developments have all but exterminated it. Mr. Karl Brooks has recently written to me that there is a station in central New York known to a few devotees of conservation, and there is a closely guarded colony in the upper Hudson Valley. Dr. Sharp has written me that the Climbing Fern is plentiful in the Great Smoky Mountains National Park in North Carolina, where it will probably be safe from depredations. I should be pleased to hear from members regarding present and former localities known to them.—JESSE F. SMITH, 347 Main St., Suffield, Connecticut.

Recent Fern Literature

COBB'S FIELD GUIDE TO THE FERNS: SOME SUPPLEMENTARY COMMENTS.—The following notes were prepared after a reading of the galley proof of Dr. Wherry's review of Boughton Cobb's Field Guide to the Ferns. I should have been glad to have them appear in the same issue with the review but was too late for such inclusion. With all due respect to Dr. Wherry, whose knowledge of ferns I hold in high esteem, I believe that his review should have included some consideration of the Field Guide from a positive, over-all viewpoint as well as an analysis of details to which he takes exception. My comments here are not a plea for the ignoring of errors of any sort, and defects can be found in the Fern Guide. When, however, the plan and objectives of the book are taken into account, it is possible to recognize among the specific points which Dr. Wherry criticizes several classes or grades of items, and among these to find some which do not deserve censure.

The first impression one gets of the book through a general survey is that it is an excellent piece of book production, well printed, copiously illustrated, and with an interesting series of supplementary chapters. It is obviously designed for amateurs, and, as Dr. Wherry

notes, the illustrations are unusually good. The keys are completely picturized for the benefit of the novice.

In pursuit of his objective, to make the text matter attractive for beginners, Mr. Cobb, who is an indefatigable enthusiast in the pursuit of ferns, has endeavored to avoid some of the technical structural terms ordinarily found in fern books. In my opinion, some of his usages are entirely legitimate, *e.g.*, "Leaflet," instead of "pinna," "Once-cut," instead of "once pinnate." However, when it comes to some of the terms used for the lesser leaf divisions, such as "Subleaflet" for "pinnules" and his use of "lobe" or "pinnulet," I am not sure these terms are well employed. My own botanical feeling was somewhat disturbed by Mr. Cobb's usage with respect to the main parts of the leaf, *e.g.*, equating "leaf" and "frond" as synonymous with "blade" (the more accurate term), and the further equating of "stipe" and "stem" with "stalk"—"stalk" would have been accurate and clear. It may be noted, however, that the novice is not likely to be confused by these points of structural nomenclature, thanks to the explicitly labelled figures that accompany the many pages of keys and species illustrations. To Mr. Cobb, also, should go the credit for planning and selecting the material from which the excellent illustrations were drawn. One objection of Dr. Wherry, that Mr. Cobb uses "leaf" instead of adopting "frond" throughout, seems entirely without merit or botanical support. The term "frond" dates from the earlier period when botanists were uncertain whether these structures in ferns were really leaves in the same sense as are the foliar organs of apples, dandelions, etc.—R. C. BENEDICT.

"THE IMPORTANCE OF FERNS TO AN UNDERSTANDING OF THE BRITISH FLORA" is a short but important paper¹ by

¹ In "Species Studies in the British Flora," edited by J. E. Lousley, pp. 90-98. 1955.

Dr. Irene Manton reviewing the results of her work and that of her students in the light of the larger question as to the origin of the present British flora. A number of common ferns that seem well adjusted to the British climate are tetraploids, each of which is closely allied to diploid forms which are much rarer. The diploids are of two types, those of Mediterranean distribution generally (*Polypodium vulgare*, *Asplenium Adiantum-nigrum*) and those of boreal distribution, in Scandinavia and elsewhere, e.g. *Dryopteris dilatata*, *D. Filix-mas*, *Cystopteris fragilis*, *Asplenium Trichomanes*. It is likely from cytological evidence that the tetraploids are of hybrid origin, one ancestor being the remaining diploid and the other unknown. There are no British species that could be the other ancestor, and probably no European species either. The conclusion is therefore to be reached that these tetraploids, now so common, did not originate in Europe, but are immigrants, probably from Asia, where the other diploid ancestor may still be in existence.—C. V. MORTON.

The chapter "Pteridology" in "A Century of Progress in the Natural Sciences, 1853-1953,"¹ is contributed by Dr. Irene Manton, the distinguished British cytologist and fern student. It traces clearly and logically the development of pteridology as a science from the time of Hofmeister (1851) to the present time, and can be highly recommended as a concise historical summary.—C. V. MORTON.

Notes and News

The early numbers of the Fern Journal contained a section entitled "Notes and News," which the editors have decided to revive. It is intended to include newsworthy items regarding members and their activities,

¹ Published by the California Academy of Sciences, San Francisco, California, 1955, in celebration of the centenary of the Academy.

including excerpts from letters. Members are urged to send in material for this section, which, it is hoped, will bring a little personal touch into the Journal.

Botany Department
The University
Leeds, England

Dear Dr. Faust,

Thank you very much for your letter of February 1st. I am naturally very pleased as well as honoured by the offer of Honorary Membership in the American Fern Society, and I will accept it with great pleasure.

I would be glad if you would convey my thanks in some form to the electors.

Yours sincerely,
Irene Manton

TO THE AMERICAN FERN SOCIETY.—My election as Honorary Member of the American Fern Society is a deeply appreciated honor. I hope I may follow the example of Campbell Easter Waters who, on a similar occasion some twenty years ago, made a semi-serious protest that he did not want to be considered “on the shelf.” In fact, he continued in active correspondence with fern friends for the nearly score of years that remained to him. He wrote for the Fern Journal, and also instituted an anonymous, annual generous contribution after the Treasurer stopped sending him bills.

Sixty years of following ferns as a hobby—I believe the start for me was during my first high school year in 1897—have not lessened my interest either in the “amateur” aspects of fern study or in the professional phases. Someone has written that all hobbyists—except epitaph collectors—like to get together with others of like interest to follow their hobbies. I am grateful for the opportunities which membership in the Fern Society has given me for friendly and stimulating associations.—RALPH C. BENEDICT.

Members of the Council were shocked and grieved to learn of the death of our newly elected Vice-President, Harold G. Rugg on February 13. Those who knew him will miss his quiet, kindly help in locating ferns in some of the beauty-spots of New England and in making his own garden available to groups. The rest of us count it a loss not to have known him personally. An account of his life will appear in another issue.—Ira L. Wiggins.

PROPOSED FIELD-TRIP AND ANNUAL MEETING.—The Annual Meeting of the American Fern Society will take place either August 26 or 27 in connection with the meeting of the American Institute of Biological Sciences at Stanford University, California. There will be a session for the reading of contributed papers. Members are urged to send immediately the titles of papers they will present to Dr. Ira L. Wiggins, Natural History Museum, Stanford University, California, who will act as program chairman and local representative. Those who will be unable to attend or whose attendance is uncertain are asked to submit titles anyway, for the papers can be read by others, if necessary.

Preceding the Annual Meeting there will be the annual field-trip which will possibly be made with the American Bryological Society. The start will be from Stanford University, and the trip will probably be for about five days, beginning August 20. Tentative plans call for driving up the Redwood Highway to Eureka and returning along the scenic coastal route of northern California. Dr. Wiggins will make the arrangements for the field-trip also. Dr. Benedict has suggested that possibly some members planning to drive from the East may wish to join together for a combined trip across the continent, possibly with some stops in the Rocky Mountains. It is essential that Dr. Wiggins have a close estimate of the number participating in the field-trip by May 25, in order that arrangements for transportation, meals, and housing may be made.—C. V. M.

SPORES OR PLANTS WANTED:—In connection with his study of the Appalachian spleenworts, Dr. W. H. Wagner, Jr. (Dept. of Botany, University of Michigan, Ann Arbor, Mich.) is in need of spores or plants of *Asplenium Stotleri*. If any member has this in cultivation he would appreciate hearing of it.

SPORES FOR DISTRIBUTION.—Spores of a new fertile form of Scott's spleenwort, *Asplenium ebenoides*, are available to interested growers. It is a highly fertile fern differing from the well-known Alabama type which has been so successful in culture work in having papery texture, pale-green color, quite regular lobulation, broader segments, broader leaf-blades, and more finely toothed leaf margins. The prothallium differs in having deeply lacerate margins. The plant was produced experimentally from wild, sterile plants collected with the parents in Montgomery County, Maryland. There are several of these plants growing currently at the Botanical Gardens of the University of Michigan. If you are interested in receiving the spores of this form for your collection of living plants, write to Professor Warren H. Wagner, Jr., Department of Botany, University of Michigan, Ann Arbor, Michigan.

American Fern Society

Report of the President for 1956

Nineteen fifty-six was, in general, a successful year for the American Fern Society. Our membership held steady, or gained slightly over that of 1955. The success in this area is attributable largely to the enthusiasm of members in enlisting the interest and support of their friends, and to the effective personal missionary work and heavy correspondence of our Editor-in-Chief. He recruited a number of new members on a trip to the western states, and while attending meetings or par-

ticipating in field forays. Our membership at the end of December totaled 582 active members.

In connection with the ever-present problem of maintaining a stable membership list, the president wrote nearly forty letters to past members who had dropped out during the preceding year and asked each one why he or she had withdrawn from the Society. As one must expect when sending out such letters, approximately one in four replied. The answers were similar to those obtained by Mr. Mann a few years ago when he attempted a similar poll. They showed that some had found the Fern Journal "too technical"; one had decided that ferns as a hobby were less attractive than another activity; two had retired from active business and had to "watch all the corners"; and a friend of one wrote that the elderly lady had passed away but no one had informed us of her death. On the basis of the small sampling, it appears that we lose members for about the same reasons as do other societies that depend on the interest of their members to keep their organizations alive. Obviously, we cannot relax for long from recruiting activities if the Fern Society is to remain vigorous.

During 1956 the activities of various regional groups have been numerous and rewarding. Reports about meetings at the New York Botanical Garden, at the Mistaire Laboratories, and about forays to favorite fern localities and to beautiful gardens that feature ferns, indicate that several groups have been active and have enjoyed the fellowship such gatherings afford. The Field trip into the Gaspé region, and the meetings at Storrs immediately thereafter, were highlights in the year's activities that the president was extremely sorry to miss. A tragic accident to a member of a field party operating in the Alaskan arctic claimed his undivided attention too far into August to permit participation in either the Gaspé foray or the Storrs meetings.

The quality of papers submitted to the Editor-in-Chief for publication in the Fern Journal was good, and the number of pages printed during 1956 was approximately the same as in each of the past few years, in spite of increased printing costs. Sincere thanks are extended to those who devoted time, thought, and inspiration to the preparation of these articles.

Incidentally, periodic increases in the cost of printing bring up a subject holding painful potentialities. The annual dues of the Fern Society are insufficient to meet the annual cost of publishing the Journal. The Council is reluctant to recommend an increase in dues, although most organizations have been forced to do so. We have met the "deficit" through the help of contributing members who have added various sums to their annual dues, and by using some of the accumulated proceeds from sale of back numbers and sets. The potential deficit can be met in the future by any one of several methods, or by a combination of two or more of them. For example, we could: (a) increase the annual dues; (b) keep the dues at their present level but work for an increase in the number of contributing members; (c) hold the dues where they are but carry on a vigorous, sustained drive for a substantial increase in our regular membership; (d) attempt to raise a substantial fund for a permanent endowment of sufficient size to cushion the Society against economic fluctuations. The method suggested under (c) seems the most promising, for the cost of printing 200 additional copies of the Journal is not as great as the increased income from 200 additional memberships.

That the Fern Journal is not without interest to botanists in other countries is attested by the fact that during 1956 two foreign institutions requested that the Fern Journal be made available to them on an exchange basis. The Council approved their request and their names

have been added to the mailing list. The Fern Society and its Journal continue to be viewed favorably by botanists in a number of European and Latin American countries.

The president wishes to thank those who generously have given time and energy to serve as officers, as members of special committees, as leaders of field-trips and chairmen of meetings, as curators of our herbarium, library, and spore collections, and as members of the Editorial Board. Hearty thanks are tendered our past president, Dr. Ralph C. Benedict, for his numerous helpful suggestions while I was trying to learn the duties of the president. Thanks are given also to those who supported the Fern Society by becoming, or continuing to be, contributing members. Finally, "Thank you!" to each individual member who has continued his or her interest in ferns and has maintained membership in the American Fern Society through another year.

It is my great privilege to extend a special welcome to two people who have long worked with ferns, studied, grown, and written about them, and who, by the action of the Council and with the voted approval of the membership, have been elected Honorary Members of the Society. I extend best wishes to Dr. Irene Manton, of the University of Leeds, England, and to Dr. Ralph C. Benedict. Their contributions to pteridology have been a source of pleasure and inspiration to us all. May their fruitful labors continue through many years.

I wish to conclude my report by voicing my appreciation for the privilege and honor of serving as president through another year, and to express the sincere wish that my services to the Society and to its members may be greater in 1957 than they were in 1956!

Respectfully submitted,

IRA L. WIGGINS, *President*

Report of the Secretary for 1956

The membership of the American Fern Society at the end of 1956 was the highest in the history of the Society—582, as compared with 564 at the end of 1955, an increase of 18 members. One new Life Member was added, our President, Dr. Ira L. Wiggins, who first joined the Society in 1932. There has been a definite increase in the number of members in New York, Florida, and California.

We regret to report the deaths of the following members: Mr. Clarence Birdseye (1952), Mr. Clarence H. Knowlton (1911), Mrs. Spencer S. Marsh (1927), Mrs. N. J. Sidney Rich (1954), and Mrs. James M. Stifler (1935), and Mrs. Edward Thurston (1940).

The annual summer field-trip was held in the Gaspé Peninsula in August; a report will be published at a later date.

The Annual Meeting of the Society was held at the University of Connecticut, Storrs, Connecticut, in connection with the A. I. B. S. meeting, on Tuesday, August 28. The morning was devoted to contributed papers, with C. V. Morton presiding. The exceptionally fine program, mostly arranged by Dr. Warren H. Wagner, Jr., consisted of the following papers: "The Experimental Hybridization of Ferns in an Artificial Environment," by Robert S. Whitmire, reported methods of creating artificial hybrids, particularly in *Asplenium*, by micro-technique; "A New Intermediate Species of *Cheilanthes* from California and its Probable Origin," by Warren H. Wagner, Jr. and Elizabeth F. Gilbert, described a probable new hybrid between *Cheilanthes siliquosa* and *C. californica* that was first studied by Mrs. Carlotta C. Hall; "Morphological and Cytological Studies of Synthetic and Wild *Asplenium Gravesii*," by Thomas Darling, Jr. and Warren H. Wagner, Jr., presented work that will soon be published elsewhere;

“Cytotaxonomic Studies of Some American Species of *Dryopteris*,” by Stanley Walker (read by Dr. Wagner), an important paper on American *Dryopteris*, which will be published in a coming number of the Journal; “Microscopic Studies of Mistaire *Dryopteris*,” by Clara S. Hires, described current work on the cell structure of the indusia of *Dryopteris*, indicating that some species may be distinguished by the indusial cells; “The Gametophyte of *Plagiogyria*,” by Lenette Rogers Atkinson, reported current work with the gametophytes of *Plagiogyria* that indicates that this genus occupies a relatively primitive and isolated position among living ferns; “Studies in the Development of Leaf Primordia and Buds in the Fern *Acrostichum danaeifolium*,” by William J. Crotty, reported some morphological investigations that are under way; “The Aquatic ‘Ferns’ of Georgia,” by Wilbur H. Duncan, contained fine color-slides of some ferns of Georgia; “A Check-list of Ferns of the Northeast, based on English Names,” by Ralph C. Benedict, gave results of work on a checklist, mimeographed copies of which were distributed to those present; “The Second Most Important Discovery about Ferns,” by Ralph C. Benedict, continued Dr. Benedict’s studies of the history of our knowledge of ferns with some account of the work of Jeffrey, Kidston and Lang, and others; and “Conservative Species and the Problem of Chromosome Numbers,” by Stanley J. Smith, discussed the emphasis that should be given to chromosome numbers in discriminating species, both in flowering plants and ferns. Unfortunately, the extremely full program allowed little time for an adequate discussion of the interesting papers. The session was well attended, there being 40 members or more present at all times.

Following the formal session for papers, the Society held a luncheon, presided over by Dr. Dwight Moore, our Vice-President, which was attended by 30 members

or more. Following the luncheon, a part of the group met again in the room that had been provided for the Fern Society as an exhibition room, where an additional, unprogrammed paper was read by Mrs. Fern Ward Crane on her spore studies in *Dryopteris*, with particular reference to *Dryopteris Filix-mas*. Several interesting exhibits were laid out by Dr. Wagner, Miss Hires, and others.

The Society is extremely grateful to Dr. Wendell H. Camp, who arranged the Annual Meeting so competently.

Respectfully submitted,

MILDRED E. FAUST, *Secretary*

Report of the Treasurer for 1956

The American Fern Society ended 1956 in good financial condition. Income amounted to \$3,658.10—the highest on record for the Society. This was helped considerably by the 82 individuals who are sustaining members, by the brisk sale of back volumes and excess library books, and by gifts. The publication costs increased slightly over 1955.

Receipts

	<i>Amount</i>	<i>Total</i>
Cash on hand, Jan. 1, 1956		\$1,509.65
1955 membership arrears	\$ 6.00	
1956 membership renewals	721.00	
1956 sustaining members	410.00	
1956 new members	90.20	
1956 subscription renewals	50.20	
1957 subscription renewals	264.10	
Life membership	50.00	
Sale of back numbers	216.22	
Sale of reprints	145.88	
Sale of surplus library books	50.00	
1956 advertising	20.00	
Gifts	124.85	
		2,148.45
		\$3,658.10

Disbursements

	<i>Amount</i>	<i>Total</i>
A. F. J. Vol. 45, No. 4	484.99	
A. F. J. Vol. 46, No. 1	526.22	
A. F. J. Vol. 46, No. 2	301.76	
A. F. J. Vol. 46, No. 3	403.60	
Reprints	163.45	
Expenses		
President	40.50	
Secretary	35.84	
Treasurer	83.09	
Editor	18.50	
		2,057.95
Cash on hand, January 1, 1957		\$1,600.15

STATEMENT DECEMBER 31, 1956

<i>Assets</i>	<i>Amount</i>
Cash on hand	\$1,600.15
Bissell Herbarium Bequest	633.69
Life Membership Fund	727.56
Reserve Fund	1,734.57
Inventory A. F. J.	3,103.91
A. F. S. Library	396.00
	\$8,195.88
<i>Liabilities</i>	<i>Amount</i>
Capital Account	\$6,127.00
Suspense credit	
1957 subscriptions	264.10
Distribution Vol. 46, No. 4, A. F. J.	443.53
Bissell Herbarium Fund	633.69
Life Membership Fund	727.56
	\$8,195.88

Respectfully submitted,
 RONALD L. MCGREGOR, *Treasurer*

Report of the Auditing Committee

We hereby certify that we have seen the books and accounts of Dr. Ronald L. McGregor, Treasurer of the American Fern Society, and have obtained confirmation of the correctness of the Society's balances on hand as set forth in detail in the accompanying report of the Treasurer.

EMILY L. HARTMAN

W. H. HERR

Auditing Committee

Report of the Librarian and Curator for 1956

The sale of duplicate books and loans from the Library and Herbarium have continued as in the past few years. In most cases, several requests were received for each book advertised; it is regretted that some members were disappointed. Members are urged to send their duplicate books to the Librarian for sale, not only to help provide additional income to the Society but also to make needed books available to fellow members.

There have been few requests for the loan of herbarium specimens; it seems that the collection could be used to better advantage than it is. Members are encouraged to ask for material, for their own study or to illustrate fern talks. Most of the species of the United States are represented, as well as a good many of those from other parts of the world.

Respectfully submitted,

ROLLA TRYON, *Curator and Librarian*

Report of the Judge of Elections

The results of the balloting for officers of the American Fern Society are as follows:

For President

Ira L. Wiggins	269
R. C. Benedict	2
C. V. Morton	1
Rolla M. Tryon, Jr.	1

For Vice-President

Harold G. Rugg 271

B. R. Allison 2

For Secretary

Mildred E. Faust 275

For Treasurer

Ronald L. McGregor 275

I therefore declare the following candidates elected to the several offices: President, Ira L. Wiggins; Vice-President, Harold G. Rugg; Secretary, Mildred E. Faust; Treasurer, Ronald L. McGregor.

For Honorary Membership

Dr. Irene Manton 280, Yes; 4, No

Dr. Ralph C. Benedict 286, Yes; 1, No

I therefore declare Dr. Irene Manton and Dr. Ralph C. Benedict elected to Honorary Membership in the Society.

Total number of ballots returned: 291.

Respectfully submitted,

BENJAMIN R. ALLISON, *Judge of Elections*

Report of the Spore Exchange

In 1956, the mails carried well over one hundred letters about fern spores to and from Fernwood, the present seat of the Spore Exchange of the American Fern Society, and this, we think, bespeaks considerable interest for so new a venture. It was gratifying that so many members and friends took the time and trouble to send spores or fertile fronds. They would feel repaid could they know the gratitude of those who used them. A list of the spores available has been mimeographed and will be sent to anyone requesting it. Besides the more common Eastern ferns, the list includes some of the rarer rock ferns, a few special forms of *Dryopteris* and *Polystichum*, some tropicals for greenhouse use, and some from the west coast, Florida and New Zealand.

Our thanks go to Dr. Wiggins for *Dryopteris fragrans*

from Alaska, to Mr. A. R. Lord for sending fourteen samples collected on the Gaspé trip of the Society, to Mr. Harold Rugg for the many times he has remembered the exchange in his travels, to Dr. Wherry, Dr. Wagner, Mr. Morton and Mr. Tom Darling for some of the Appalachian Aspleniums, to Mrs. Fern Crane and Mrs. Norman Henry for some ferns especially requested, to Mrs. Diddell and John Beckner for Florida ferns, and to all others that sent material. Each packet is appreciated.

Though the number of contributors (24) has materially increased this year, the number of those requesting spores has dropped, and this seems too bad. With a kitchen oven, a few pots or dishes and some pieces of glass for cover (or polyethylene bags) being readily available to everyone, it seems that a lot of pleasure for little trouble is being missed. Sometimes, one gets something quite unexpected in addition to or instead of what he thought he planted, but this can be disappointing, distressing or exciting according to the point of view. It is a magic sort of business that can take place on your windowsill, and should be tried by every person interested in ferns, whether professional botanist or amateur hobbyist.

It would be fine if in 1957 the number of contributors to the exchange would equal or outnumber those of 1956, and at the same time the number of users be greatly increased! In either case, contact MRS. KATHRYN E. BOYDSTON, *Fernwood, Route 3, Niles, Michigan.*

Report on the Massachusetts Meeting

The summer meeting of the New England section of the American Fern Society was held at Bartholomew's Cobble, Ashley Falls, Massachusetts, on June 22nd and 23rd. Thirty members and guests of the Society attended. The headquarters were at the Sheffield Inn, three miles from Ashley Falls.

Bartholomew's Cobble has been described as "nature's rock gardens at perfection." It is a wooded hill with numerous outcroppings of limestone rock, situated on the Housatonic River, near its source. It is maintained as one of the State of Massachusetts' public reservations. Over five hundred species of plants, including about 30 kinds of ferns, are found there.

Meeting at the Sheffield Inn at ten o'clock Saturday morning, the party proceeded to the Cobble, where the warden, Mr. Waldo Bailey, conducted us through the reserve. Lime-loving ferns grew in abundance. *Asplenium platyneuron* and *trichomanes* were very plentiful. There were a few plants of *Asplenium ebenoides* (Scott's spleenwort) and *Asplenium ruta-muraria*. Several rocky ledges were actually covered with *Camptosorus rhizophyllus* and *Pellaea atropurpurea*. A fern which created great interest was *Ophioglossum vulgatum*.

After a picnic lunch some of the group further explored the Cobble while others did independent ferning down a nearby road.

Later in the afternoon two private gardens in Falls Village, Connecticut, which is but a short distance away, were visited. These gardens were of special interest, both because of their content and charm and the fact that their owners, Mr. Boughton Cobb and the Lincoln Fosters were collaborators in the preparation of Mr. Cobb's book "Field Guide to the Ferns," which has just been published. Mrs. Foster did the exquisite drawings for this book.

Among the unusual ferns seen in these gardens were: *Asplenium viride*, *Asplenium ebenoides*, *Asplenium resiliens*, *Asplenium montanum*, *Cryptogramma stelleri*, *Cheilanthes lanosa*, *Woodsia glabella*, *Adiantum capillus-veneris* and *Lygodium palmatum*. There were also several plants of a form of *Cystopteris bulbifera*, discovered near Falls Village and described by Mr. Foster in the

American Fern Journal (Volume 44, No. 3). Mr. Foster also showed an interesting group of various forms of the Christmas fern.

That evening at the Sheffield Inn an informal discussion of the day's finds took place. Dr. Benedict had provided check-lists which were used by many. Forty-seven kinds were checked.

The next morning Miss Ruth Hardy's fern and wildflower nurseries in Falls Village were visited. A large variety of ferns and wildflowers grew along the paths in her woods, many of them in their native state. Later some of the group re-visited the Cobb and the Foster gardens.

Everyone missed Dr. Benedict, who at the last moment was unable to attend. It is a tribute to his training, that without his experienced leadership, we were able to carry on and have such a pleasant and profitable meeting.—BENJAMIN R. ALLISON, M.D., *Chairman of New England Committee*.

Meeting at the New York Botanical Garden

On December 1, 1956, the American Fern Society had a most fruitful and profitable informal meeting at the New York Botanical Garden. Twenty-eight members were present from four states—New York, New Jersey, Pennsylvania, and Connecticut. The meeting was sponsored by a committee consisting of Miss Clara S. Hires, and Messrs. Allen, Allison, Benedict, and Graf. Dr. Donald Rogers, of the staff of the New York Garden, acted as host for the Botanical Garden, and set up in advance some very interesting displays from the Garden's extensive library of fern books, and herbarium specimens. Miss Hires and Dr. Allison spread the word of the meeting through the distribution of a notice prepared by Dr. Rogers.

Those attending had the opportunity of choosing dur-

ing the morning whether they would visit the Garden fern-house, the Library, or the Underwood Fern Herbarium. In the library (one of the largest botanical ones), the Librarian pointed out rare and old books and searched for special references for some of us. In the fern herbarium, some did research of their own; others were given a general survey by members of the Garden staff. In the Members' Room, Dr. Rogers had placed on display an extensive series of popular fern books, including the pioneer of all—that by James Bolton. One special volume was “The Ferns of Great Britain and Ireland” by Thomas Moore, edited by John Lindley, London. The life-sized illustrations in this volume had been “nature-printed”—whole fern leaves were first impressed on lead plates under considerable pressure, and then the plates were printed from the lead plates, and beautifully colored. Other exhibits included a set of 75 different living ferns, usable as house plants, exhibited by Mr. A. B. Graf, of Julius Roehrs Company, Rutherford, New Jersey, an extensive showing of Charles Neidorf's beautiful enlargements, some developing spore cultures in plastic dishes, shown by Ralph Benedict, from which individual specimens were available, and spore models shown by Miss Hires.

At noon, all gathered in the Members' Room where we were served coffee and cookies by the Botanical Garden to supplement our sandwiches. This room was especially appropriate since it was formerly the working laboratory of Prof. Lucien M. Underwood, the leading professional fern student for many years, with publications covering popular and technical phases of fern study from 1880 for nearly 30 years. Here were displayed also most of the exhibits mentioned above.

After lunch we remained in the same room where Ralph Benedict led an informal discussion on “Ferns as a hobby,” with distribution of his English name

check-list of northeastern ferns. Dr. Norman P. Marengo gave a talk on his studies of the spore structure of several species illustrated by lantern slides. Miss Hires discussed spores and spore structure, showing many photo-enlargements made for her by Mr. Gordon Foster. Mr. Graf talked about some of the most interesting of the collection of 75 living species.

For the Botanical Garden, Dr. Rogers had organized the day's activities so beautifully that, at first, one could hardly realize how much time and energy must have been used to attain the results. It is pleasant to report that the Society now has a Botanical Garden member in the person of Dr. Rogers. The following is a list of those who signed the registry of the meeting: Benjamin Allison, R. C. Benedict, Muriel Brown, Boughton Cobb, Mr. & Mrs. Burton Dezendorf, Mr. & Mrs. H. F. Dunbar, Mrs. F. G. Dunham, Ann Dunham, Mildred Faust, Thorleif Fliflet, Mr. & Mrs. F. Gordon Foster, A. B. Graf, Clara Hires, Norman Marengo, Charles Neidorf, Eugene G. Rhodes, Marion Rhodes, Donald Rogers, Eva Sobol, Harry Trudell, Gunnar Weller, and Edgar T. Wherry.
—MILDRED FAUST, *Secretary*.

GASPÉ FIELD-TRIP.—Because of the number of other reports in this number, a report on the field-trip last summer to Gaspé will be published in the next issue.

NEW MEMBERS

Mrs. Mona Ayers, 6655 Bellefontaine, Kansas City 30, Mo.

Mr. James A. Bateman, Box 114, Slidell, La.

Mr. William F. Blois, Jr., Route 6, Box 386, Jacksonville 7, Florida

Mrs. O. S. Bryant, Jr., 3470 Afton Ave., Paducah, Ky.

Mr. Daniel H. H. Casebeer, Box 4034, Walker Station, Tulsa 9, Okla.

Mr. Burton Dezendorf, 401 Hasbrouck Blvd., Oradell, New Jersey

Mr. Sidney K. Eastwood, 526 Madison St., New Orleans 16, La.

Mr. Peter Enrietta, R. R., Coal City, Illinois

Miss Ruby C. Ferguson, Rosharon, Texas

Mr. F. Gordon Foster, 10 North Terrace, Maplewood, N. J.

- Mrs. J. O. Franklin, 107 Lawrence, Bruceton, Tenn.
 Mrs. George N. Gardiner, Pond Crossing, Lawrence, L. I., N. Y.
 Mrs. George H. Gardner, 1724 Asbury Avenue, Evanston, Illinois
 Mr. Jarl Hiltunen, c/o Biology Department, Wayne State Univ.,
 Detroit 2, Michigan
 Mr. A. E. Horn, 33-52 156th Street, Flushing 54, New York, N. Y.
 Mrs. Phil James, 5620 S. W. 67th Ave., Miami, Florida
 Mr. Thomas B. McGuire, 5th and Fairmount Street, Coopersburg,
 Pa.
 Miss Barbara Monish, Chester Street, Chester, New Hampshire
 Mrs. Annette Moore, 210 26th St., Old Hickory, Tennessee
 Miss Yolanda Orta, 74386 Bradock Drive, Culver City, California
 Mr. Edward Pisler, 157 Havelock Street, Toronto 4, Ontario, Can-
 ada
 Mr. Harry K. Roberts, Box 64, Guerneville, Calif.
 Dr. Donald P. Rogers, New York Botanical Garden, New York 58,
 N. Y.
 Dr. Ruegger, Tiefengrabenstrasse 1, Binningen 1BL, Switzerland
 Mrs. H. B. Showalter, 6 N. 28th St., Camden 5, N. J.
 Mrs. E. E. Stowell, R. D. 1, Baileys Mill Rd., Basking Ridge, N. J.
 Mrs. C. G. Webb, 20 West Ave., Wellsboro, Pa.
 Mr. Stanford Young, 214 Avery St., Hot Springs, Arkansas
 Mr. John Zapp, 3443 Afton Ave., Paducah, Ky.

CHANGES OF ADDRESS

- Mrs. Marion B. Brettle, El Rancho Mobile Village, Bradenton, Fla.
 Mr. Lionel Cinq-Mars, 13 Bouthillier, St. Jean, Quebec, Canada
 Dr. Donovan S. Correll, Texas Research Foundation, Renner, Texas
 Mr. Alvin B. Cutler, 7675 S. W. 128 St., Miami, Florida
 Miss Gertrude E. Douglas, 32 Clinton Road, Melrose 76, Mass.
 Mr. Neal W. Gilbert, 221 Linden Ave., Ithaca, N. Y.
 Mr. F. C. Greene, Forest Haven Apts., 2838 Forest Ave., Kansas
 City, Mo.
 Miss Inez Hartsoe, 742 W. Court St., Piggott, Arkansas
 Mr. Ed Lee, 6427 Pinehaven Rd., Oakland 11, Calif.
 Dr. Robert H. Mohlenbrock, Dept. of Botany, Southern Illinois
 University, Carbondale, Illinois
 Mr. and Mrs. Dale G. Oechler, 635 Springfield Ave., Berkeley
 Heights, N. J.
 Mrs. Ruth Schurr (nee Miss Ruth Rosa), 312 South Summit St.,
 Bowling Green, Ohio
 Dr. Aravilla M. Taylor, Andes, New York
 Mrs. L. A. Walters, 9422 Broadway, Temple City, Calif.

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

C. V. MORTON

R. C. BENEDICT

IRA L. WIGGINS

A. C. SMITH

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The American Fern Society

Council for 1957

OFFICERS FOR THE YEAR

- IRA L. WIGGINS, Dudley Herbarium, Stanford University, California *President*
DR. BENJAMIN R. ALLISON, 26 Ives Road, Hewlett, L. I., New York *Vice-President*
MILDRED E. FAUST, Department of Botany, Syracuse University, Syracuse, New York *Secretary*
RONALD L. MCGREGOR, Department of Botany, University of Kansas, Lawrence, Kansas *Treasurer*
C. V. MORTON, Smithsonian Institution, Washington 25, D. C. *Editor-in-Chief*
-

OFFICIAL ORGAN

American Fern Journal

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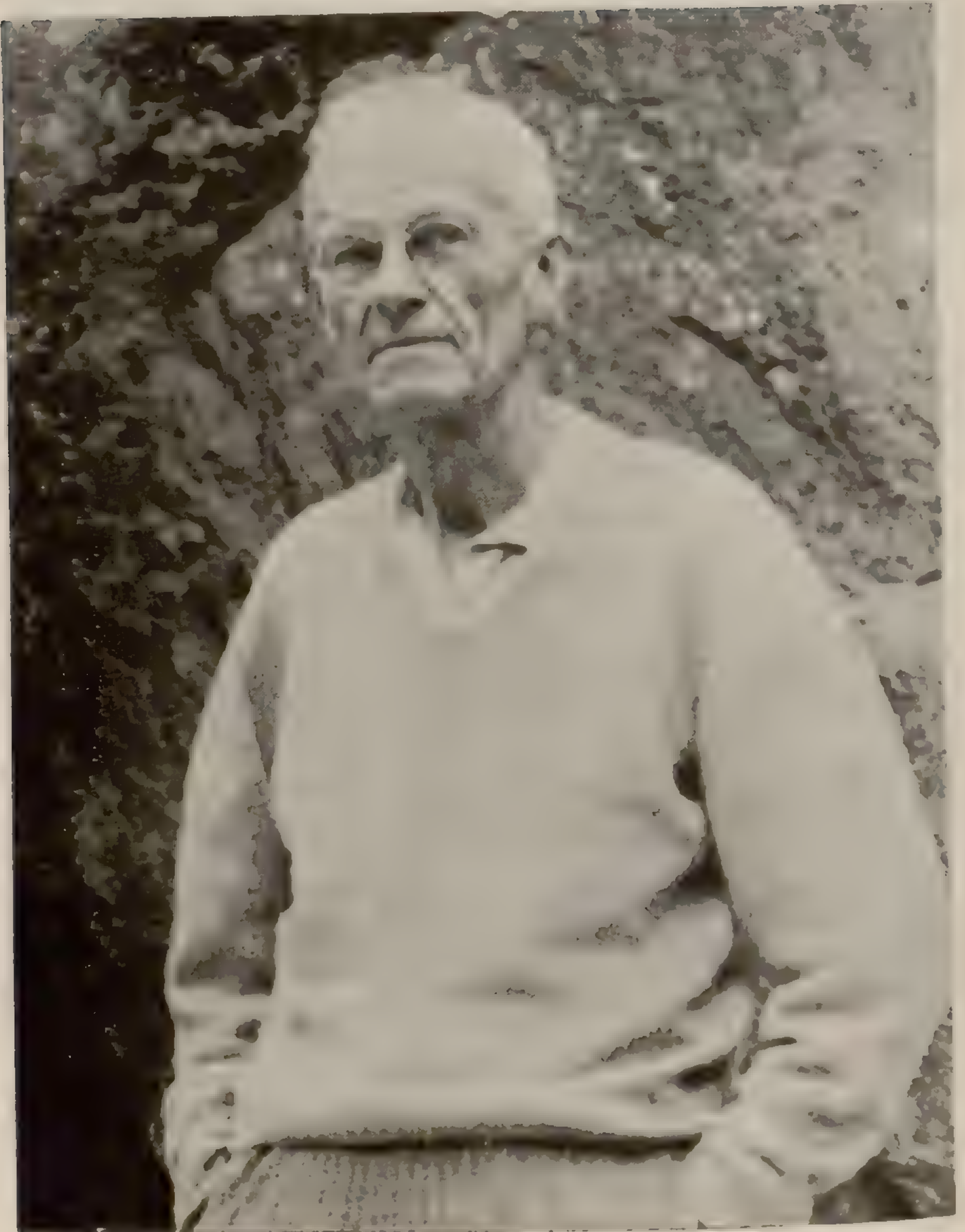
Harold Goddard Rugg—1883-1957

R. C. BENEDICT

“Ave atque Vale!” is a fitting salute to Harold Goddard Rugg. Only shortly after being elected Vice-President of the American Fern Society, he died on February 13 after a short illness. But he had already begun another year of working for the Fern Society by aiding in the planning for a field meeting scheduled for Vermont during July.

His cooperation with other fern students had extended over a period of at least 50 years. A member of the Society from 1906 onward, a postcard from him in 1907 carried the following: “Is there anything I can collect for you? Do you expect to be up Vermont or N. H. way this summer? I found *D. Boottii* for the first time this last week. I saw growing one plant of *A. ebenoides*.” Ezra Brainerd, veteran Vermont botanist, reports in the first volume of the Fern Journal¹ that Rugg had found one of the Dowell hybrids, *D. Goldiana* × *marginalis*, as early as 1907, although he did not correctly identify it till two years later. In this same period, he was raising ferns from spores and attempting to produce hybrids by mixing species in his spore cultures. Rugg went on to find many rare ferns, in many parts of the United States and to visit England and the European continent in his fern hunting. As early as 1908 he writes of importing special ferns from an English dealer—“30 plants of

¹ This JOURN. 1: 78, 79. 1911.
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HAROLD GODDARD RUGG

hardy ferns native in Europe and Japan.” Not all his fern expeditions were successful; one card carries the query “What am I likely to find in the Dismal Swamp region?” to be followed by another—“In my Virginian Rambles, the only fern I found was *Pteris aquilina pseudocaudata*.”

But fern hunting and fern gardening were merely Rugg's hobby. To Dartmouth, he was a librarian, the College expert on rare books, who gave a course on the “art of books.” His library service at Dartmouth, begun part-time when a junior in 1905, became his full time vocation immediately after his graduation in 1906. On more than one occasion, the College honored him for his unremitting services; before his retirement in 1953, he had been made Associate Librarian with the rank of full professor. During his Dartmouth service, Rugg was one of the earliest to recognize the genius of Robert Frost and gave appreciated help in the struggling days of the poet by arranging a lecture engagement at Dartmouth. At his death, his personal library included a valuable collection of the works of Frost.

In Vermont, Rugg's birth-state, he was highly regarded as an expert on Vermont history and indeed he had national recognition in this field. Long a member of the Vermont Historical Society, and active as a Director, he left a library of over 2300 volumes and over 3000 documents and manuscripts on the origins and development of Vermont communities. A major literary project of his, which we may hope was ready for publication, was a detailed account of every village and other community of the state of Vermont.

Rugg's notable fern garden in Hanover was left to Dartmouth College, which has decided that it will be unable to maintain it. Negotiations are therefore under way to distribute the rare plants in the garden to institutions where they will receive adequate care.

Observations on Cultivated Ferns, II. The Proper Generic Name of the Holly Fern

C. V. MORTON

The Holly Ferns are among the most prized of cultivated ferns, for they are relatively easy of cultivation and their thick, leathery, glossy leaves are ornamental. They have long been universally known under the generic name *Cyrtomium*, although doubtless some dealers list them as species of *Polystichum*, a not altogether unreasonable disposition. Convincing generic distinctions from *Polystichum* are hard to find; still, if all slightly tenuous genera of ferns were to be reduced to synonymy the result would be having only a few very large genera, not perhaps the most convenient treatment in practice.

The purpose of this note is, however, not to discuss the relationship of *Cyrtomium* to *Polystichum* but to *Phanerophlebia*, which is even more closely allied. Copeland, in his *Genera Filicum* (1947), discussed these two, concluded that they were synonymous, and adopted the name *Phanerophlebia* for the combined genus, reducing *Cyrtomium* to synonymy. Copeland is not original in deciding that these groups are not generically separable; the same conclusions and on the same grounds were reached by Thomas Moore¹ and John Smith.² The only original thing is the conclusion that the proper generic name is *Phanerophlebia*, an erroneous conclusion, as it turns out.

The two genera *Phanerophlebia* Presl and *Cyrtomium* Presl were described at the same time (1836) in Presl's *Tentamen*, the former on page 84 and the latter on page 86. This so-called "page priority" of *Phanerophlebia* must be the reason for Dr. Copeland's choice of name, but this is not a valid reason. Page-priority has nothing to do with it. The rule in the International Code of

¹ *Index Filicum* LXXXII. 1857.

² *Historia Filicum* 204. 1875.

Botanical Nomenclature (1956 edition) regarding the choice of names of the same date is in Article 57: "The author who first unites taxa bearing names or epithets of the same date has the right to choose one of them, and his choice must be followed." In this case, T. Moore, in his *Index Filicum* (1857, p. LXXXII) united *Phanerophlebia* and *Cyrtomium*, and chose the name *Cyrtomium* for the combined genus. He must be followed. In order for *Phanerophlebia* to be right, it will be necessary for Copeland to show that between 1836 and 1857 some author did the reverse of Moore's action, i.e. adopt *Phanerophlebia* and reduce *Cyrtomium* to synonymy, which in all probability can not be done, for it almost certainly never happened.

As shown by the above technical discussion of the nomenclature, the correct name for the Holly Fern remains *Cyrtomium*, as it is usually known. The principal systematic account of this genus appeared in the *American Fern Journal* in 1930.³ In all likelihood, only three species of true *Cyrtomium* are in cultivation in the United States. The following key to them is adapted from that of Christensen cited above.

- Fronds thick-coriaceous in texture, the margin thick and quite entire *C. falcatum*.
- Fronds thinner, the margins minutely but sharply toothed, at least toward the apex of the pinnae.
- Pinnae 3 to 6 pairs, large (6-10 cm. long and 3-5 cm. wide), mostly strongly auriculate, mostly toothed throughout, the terminal pinna as large as the others or larger; stipe scaly chiefly at the base, the rhachis only slightly fibrillose. *C. caryotideum*.
- Pinnae 10 pairs or more, rather small (rarely more than 6 cm. long or 2 cm. broad), rarely subauriculate, usually toothed near the apex only, the terminal pinna smaller; stipe of young fronds densely scaly with large scales, the rhachis fibrillose with broader linear scales mixed with woolly, hair-like fibrils *C. Fortunei*.

³ "The Genus *Cyrtomium*," by Carl Christensen. This JOURN. 20: 41-52. 1930.

The American species of *Cyrtomium* occur from the southwestern United States south throughout Central America to northern South America. They are probably not in cultivation, except possibly in local gardens in Texas, New Mexico, or Arizona, where plants have been brought in from the wild. The only systematic treatment is that of L. M. Underwood,⁴ and a good one it is. No one has contributed anything of importance to our knowledge of the genus since, except for the discovery and description of a West Indian species. Only two of the species, namely *Cyrtomium juglandifolium* (Humb. & Bonpl.) Moore (Ind. Fil. LXXXIII. 1857)⁵ and *C. nobile* (Schlecht. & Cham.) Moore, *loc. cit.*,⁶ have ever been transferred formally to the genus *Cyrtomium*. The others are:

CYRTOMIUM auriculatum (Underwood) Morton, comb. nov.

Phanerophlebia auriculata Underwood, Bull. Torrey Bot. Club
26: 212. pl. 360. 1899.

Texas, New Mexico, Arizona, Sonora, and Chihuahua.

CYRTOMIUM umbonatum (Underwood) Morton, comb. nov.

Phanerophlebia umbonata Underwood, Bull. Torrey Bot. Club
26: 211. 1899.

Texas, Nuevo Leon, Coahuila, Tamaulipas, and Durango.

CYRTOMIUM remotisporum (Fournier) Morton, comb. nov.

Phanerophlebia remotispora Fournier, Mex. Plant. 1: 100. 1872.
Veracruz, Oaxaca, Puebla, San Luis Potosí, Jalisco, and
Michoacán.

CYRTOMIUM pumilum (Mart. & Gal.) Morton, comb. nov.

Aspidium pumilum Mart. & Gal. Mém. Acad. Brux. 15: 64.
1842.

Phanerophlebia pumila Fée, Gen. Fil. 282. 1852.

Oaxaca, Chiapas, Guerrero, Veracruz, Michoacán. Probably a
valid species, but its relationships to the others need to be
investigated.

⁴ "The Genus *Phanerophlebia*," by L. M. Underwood. Bull. Torrey Bot. Club 26: 205-216. 1899.

⁵ The reported range is: Veracruz, Chiapas, Guatemala, Nicaragua, Costa Rica, Panama, and Venezuela, with a doubtful record from Colombia.

⁶ The reported range is: Veracruz, San Luis Potosí, Hidalgo, Puebla, Tlaxcala, and Jalisco.

CYRTOMIUM **macrosorum** (Baker) Morton, comb. nov.

Aspidium juglandifolium var. *macrosorum* Baker, Journ. Bot.
25: 25. 1887.

Phanerophlebia macrosora Underwood, Bull. Torrey Bot. Club.
26: 213. 1899.

Chiapas, Guatemala, Costa Rica, Panama.

CYRTOMIUM **guatemalense** (Underwood) Morton, comb. nov.

Phanerophlebia guatemalensis Underwood, Bull. Torrey Bot.
Club. 26: 214. 1899.

Guatemala.

CYRTOMIUM **haitiense** (C. Chr.) Morton, comb. nov.

Phanerophlebia haitiensis C. Chr. Kungl. Svensk. Vet. Handl.
ser. 3, 16, no. 2: 41. 1937.

Haiti.

SMITHSONIAN INSTITUTION, WASHINGTON, D. C.

In Search of the Rock-fern Hybrid *Asplenium Gravesii*

THOMAS DARLING, JR.

In 1935 I first became interested in searching for rare species of the genus *Asplenium*. At that time I happened to see herbarium specimens of *A. Bradleyi* (Bradley's Spleenwort) and *A. pinnatifidum* (Lobed Spleenwort) from the Susquehanna River ravines of Lancaster and York Counties in Pennsylvania collected by the late John K. Small, of the New York Botanical Garden.

While temporarily located in Allentown, Pennsylvania, in 1937, I wrote Dr. Small a letter asking whether these ferns might still be found in the ravines. His reply stated, in part, "Lancaster County is a very interesting place for ferns. The years I spent there at college (Franklin and Marshall) resulted in the discovery of many localities for both *A. pinnatifidum* and *A. Bradleyi*. These ferns are plentiful at all the localities mentioned in your letter and at others, and no doubt the plants are just as numerous there today as they were in the past

because little has been done to exterminate them where they grow. *Asplenium Bradleyi* was not as widespread as *A. pinnatifidum*, but the ravines along the Susquehanna below Safe Harbor, both on the Lancaster and York County sides of the river yielded many beautiful specimens of this fern (*Bradleyi*), once considered so rare. In fact, it was one of the later discoveries, and even after its discovery was slow showing up in the various parts of its present known range."

Unfortunately, I was to learn that Dr. Small's optimistic prediction that these ferns were still abundant in the area did not prove true. The climate has been getting warmer and drier during the past fifty years and these rock-ferns, where once plentiful, have gradually been disappearing. Furthermore, the relocation of the railroad line along the Susquehanna River led to the extermination of many of the best known localities for the rarer species, including the hybrids, while the total disappearance of *A. Bradleyi* from the beautiful Tucquan Ravine many years ago was caused primarily by the ravages of thoughtless collectors. At one time, according to Dr. E. T. Wherry, over a hundred plants of this rare fern were to be found on a cliff at the end of the road down this ravine.

In the summer of 1937, I chose this same Tucquan Ravine for my first exploring trip in the area, on a rainy weekend culminating in a series of cloudbursts. Despite the unfavorable weather, I succeeded in finding the Lobed Spleenwort (*A. pinnatifidum*) and also collected my first hybrid, Trudell's Spleenwort (*A. Trudellii*), a cross between *A. montanum* and *A. pinnatifidum*. This initial expedition was followed by others in the Susquehanna ravines of Lancaster and York Counties, resulting in the discovery of many more localities for the two above-mentioned species, although *A. Bradleyi* eluded me for some time; I did find it later at infrequent intervals

in a number of different states, including one station in Pennsylvania (Lancaster County.)

About this time I learned about the extremely rare hybrid *A. Gravesii*, a cross between *A. Bradleyi* and *A. pinnatifidum*. Few botanists have ever seen this fern, although it had been found occasionally many years ago in certain ravines of York and Lancaster Counties. The reason for its extreme rarity lies primarily in the fact that one parent, *A. Bradleyi*, is itself relatively uncommon.

Came World War II, and in 1942 I was inducted into the Army. While stationed at various Southern camps, I continued my search for ferns, particularly *A. Gravesii*, on free week-ends. At Kings Mountain, South Carolina, I found *A. Bradleyi* at the one spot where it is locally frequent, but no *A. pinnatifidum* occurs in the vicinity. Near Macon, Georgia, I saw *A. pinnatifidum* at its extreme southeastern limit, and at Stone Mountain, near Atlanta, a local botanist showed me both *A. pinnatifidum* and *A. Bradleyi* growing sparingly near the summit, but there was no trace of a hybrid.

Not far from Gadsden, Alabama, lies a local beauty spot known as Noccalula Falls, where Black Creek plunges in a thunderous cascade over a picturesque amphitheatre of rock. I visited this botanist's paradise several times during the spring of 1944, finding numerous plants of both *A. Bradleyi* and *A. pinnatifidum* in the scenic gorge below the falls. Although I failed to uncover *A. Gravesii*, which Dr. Wherry had found in this locality many years before, I did manage to discover several specimens of *A. Trudellii*, a new station for this plant.

After the war ended, I became established in Washington, D. C., in 1946, where I have remained up to the present time. During the past ten years, I have concentrated on visiting areas where the parent ferns exist

near one another, in the hope of finding *A. Gravesii*. In this quest I was greatly aided by information given me by Dr. Wherry, and also by Dr. Warren H. Wagner, Jr., of the University of Michigan, who has been anxious for some time to obtain living plants of this rare hybrid for his studies of reticulate evolution in the Appalachian *Aspleniums*.¹ Even as late as June 1954 in the article in *Evolution* quoted above, Dr. Wagner stated, with reference to the two hybrids *A. Gravesii* and *A. kentuckiense*, "Both are exceedingly rare, and no living material has been seen by the author or is expected in the near future."

Among those places visited, but with no success, were two formerly supposed (and previously published) stations for *A. Gravesii*—one near French Creek, Upshur County, West Virginia,² the other near Chatham, Pittsylvania County, Virginia.³ In neither instance has *A. Bradleyi* been found in the general area. A recent more critical appraisal of existing herbarium specimens of the French Creek hybrid by Dr. Wagner has led to its re-identification as *A. Trudellii*. Both *A. montanum* and *A. pinnatifidum* are in evidence at French Creek. In September 1952 I here observed a luxuriant growth of *A. Trudellii* (formerly believed to be *A. Gravesii*), with some fronds attaining a length of eight inches or more.

My visit to the Pittsylvania County [Virginia] location in November, 1951, resulted in failure to locate any spleenworts other than the common *A. platyneuron* in the vicinity of Moses Mill Pond, where it was reported that *A. Gravesii* was discovered in 1939 by Dr. A. B. Massey, of the Virginia Polytechnic Institute. For a

¹ Amer. Fern Journ. 43: 109–114. 1953; *Evolution* 8: 103–118. 1954; *Rhodora*. 57: 219–240. 1955

² Amer. Fern Journ. 16: 97, 98. 1926; *The Pteridophytes of West Virginia*, W. Va. University Bull. August 1938, p. 35.

³ Bull. Va. Polytech. Inst. 37, no. 7: 40. May, 1944; Amer. Fern Journ. 34: 61–62. June, 1944.

critical recheck of Dr. Massey's herbarium specimens, one of the two sheets was recently forwarded to C. V. Morton, who considered that it might represent *A. kentuckiense*, and forwarded it to Dr. Wagner for verification. It is now established that Dr. Massey's discovery is actually the extremely rare *A. kentuckiense* (*A. pinnatifidum* $\times$ *A. platyneuron*), rather than *A. Gravesii*.

Misidentification of *A. pinnatifidum* "crosses" such as this Virginia example and the previously mentioned French Creek hybrid is easily possible, as Dr. Wagner has pointed out, because of their very subtle differences.

By the end of 1953, I had become so convinced that I would not find *A. Gravesii* in its natural state that I decided to attempt hybridizing it artificially from spores of the parent plants. Accordingly, in January, 1954, I collected spore-bearing fronds of *A. Bradleyi* and *A. pinnatifidum* along the Shenandoah River northeast of Front Royal, Virginia, where there are thriving colonies of both plants. Since, however, the cliffs where these respective ferns grow are approximately eight miles apart, there is little likelihood of discovering the hybrid, nor, after considerable searching, have I ever succeeded in so doing.

Immediately after collection, the spores of the parent plants (some six or seven months old from date of maturity) were mixed together and sown on the surface of damp, unsterilized and well sifted peat moss in three two-inch pots and placed in a covered glass bowl six inches in diameter. Aside from the light of the morning sun for a few hours each day, the pots remained for the most part in relative shade.

No recognizable prothallia appeared for at least several months, and the development of sporophytes was surprisingly slow. About midsummer the first tiny sporophytes became visible, but it was not until autumn that



SYNTHETIC HYBRID NO. 2 PRIOR TO SHIPMENT TO UNIVERSITY OF MICHIGAN.

they were large enough for removal from the peat moss. In September, 1954, the sporophytes were transplanted to a soil mixture of gravelly loam affording good drainage, and two months later the small ferns were transferred to individual two-inch pots. Shortly thereafter, a sufficient number of plants had developed from the original "culture" to warrant placing thirty-seven pots (each containing a single plant) in a glass window box, or terrarium, about thirty inches long, twelve inches wide and fifteen inches deep. Three removable glass panes in sections at the top provided convenient access to the interior. The box was placed on a table close to an east-facing window, where the rays of the morning sun created a humid jungle-like atmosphere promoting the speediest possible growth. A sheet of tissue on the sunny side protected the young tender plants from the direct sunlight. Throughout the entire experiment only distilled or rain water was used, since city tap water is often injurious.

By February, 1955, it became fairly obvious that, of the above-mentioned 37 plants, 17 of the young sporophytes were *A. pinnatifidum*, 17 *A. Bradleyi*, and three intermediates represented the hybrid *A. Gravesii*, combining the characteristics of the parents. This intermediate form is apparent by (1) the stalked effect of the lower pinnae (which are frequently paired) and by the chestnut brown color of the stipes extending well into the rachis, indicating the *Bradleyi* influence; and (2) by the heavier texture and caudate apex of the fronds, as well as the rounded lobes of the pinnae, indicating the *pinnatifidum* influence (See Plates I, II and III).

In May, 1955, the three putative *A. Gravesii* specimens were transplanted from two-inch to two and one-half inch individual pots in gravelly loam, and at this warm



DEVELOPMENT OF FRONDS OF SYNTHETIC HYBRID No. 4, SHOWING EVOLUTION FROM EARLIEST PERIOD TO MATURITY. NOTE THE TRIANGULAR SHAPE OF YOUNG FRONDS AND FREQUENT PAIRED EFFECT OF STALKED BASAL PINNAE.

season of the year one plant in particular grew to rapid maturity. This fern (which I have called Synthetic *Gravesii* #1) reached maturity long before the others, and from the very beginning was outstanding in appearance as a typical specimen of the hybrid. In August, 1955, the entire potted plant, with many fertile fronds, was sent to Dr. Wagner at the University of Michigan to serve as living material for his studies. Considerably later, synthetic hybrids #2 and #3 developed to maturity, and in June, 1956, were similarly sent on to Ann Arbor for study. Three more hybrids have since been formed, two of which have presently reached maturity.

In August, 1956, Dr. Wagner read at the Annual Meeting of the American Fern Society at Storrs, Connecticut, our joint paper "Morphological and Cytological Studies of Synthetic and Wild *Asplenium Gravesii*." The results of Dr. Wagner's conclusions are presently being incorporated in final form, and will soon be published under the revised title, "Synthetic and Wild *Asplenium Gravesii*."

Some mention may be made of the difficulties I encountered in raising ferns from spores. At one point during the experiment an over-moist condition in the terrarium led to the development of a destructive slime-mold that killed several of the parent plants almost overnight, but fortunately spared the hybrids. Later a colony of plant lice, or aphids, spread rapidly through the enclosure, devouring in particular the young unfolding crosiers. These aphids were eliminated by spraying with a weak solution of "Black Leaf 40", a nicotine sulphate solution. Finally, some of the organisms, related to the bacteria, known as Actinomycetes formed cottony patches on the pinnae, again due to an over-moist condition, which was soon remedied.

In November, 1954, nearly a year after I started my



LEFT AND RIGHT—A. PINNATIFIDUM AND A. BRADLEYI (RESPECTIVELY), FROM FRONT ROYAL, VIRGINIA; CENTER—X A. GRAVESII FROM SAND MOUNTAIN, GEORGIA.

experiment, but prior to the time that any of the young sporophytes could be recognized definitely as hybrids, I made a trip to Sand Mountain, Collier County, Georgia, 2½ miles west of Trenton, the type locality for *A. Gravesii*, where E. W. Graves in 1917 first discovered the hybrid which was named for him.⁴

Prior to visiting Sand Mountain itself, I revisited Noccalula Falls near Gadsden, Alabama, that botanist's paradise which I had explored some ten years previously. The return trip proved a nightmare! Due to recent droughts, not a drop of water flowed over the rock amphitheatre and severe forest fires had ravaged the entire gorge, once so beautiful. No *A. Bradleyi* at all was in evidence, and only a few singed and withered plants of *A. pinnatifidum* were to be seen, high enough on the cliff to have escaped total destruction.

Continuing northward to Sand Mountain, below Look-out Mountain and Chattanooga, I spent considerable time exploring with care the crevices in the sandstone cliffs of this region near the boundary line between Georgia and Alabama. Much to my relief, the parent plants at Sand Mountain had survived the drought surprisingly well. After observing nothing but these two species at frequent intervals, towards the end of the day I discovered two relatively immature plants, in different locations, that actually appeared to be the long-sought *A. Gravesii*. One was growing in the same crevice with *A. Bradleyi* and only a short distance above *A. pinnatifidum*. I chiseled it out of the rock carefully, to preserve as much of the root structure as possible. The other specimen was collected accidentally, together with *A. Bradleyi*, some distance away. The exact details of its location with respect to both parent plants thus remains unrecorded.

⁴ Amer. Fern Journ. 8: 1-3. 1918.

These two ferns (including root structures) were kept alive by placing them in a glass jar with moistened Kleenex. Upon my return to Washington, they were both mailed immediately to the University of Michigan for identification. Dr. Wagner's prompt reply brought the encouraging news that they did actually appear to be specimens of the rare *A. Gravesii*, but also disclosed the unfortunate fact that both plants were badly damaged en route. The moist Kleenex had formed into a heavy ball which banged around loosely in the jar and practically annihilated them. One plant, the weaker of the two, died shortly thereafter. The other Sand Mountain hybrid, having received the greatest possible care by Mr. Kleinschmidt at Ann Arbor, survived the ordeal in miraculous fashion, and later grew into a normal mature *A. Gravesii* with fruiting fronds attaining (by the summer of 1956) a length of nearly six inches.

The University of Michigan was then in the unique position of having available for study, side by side, mature living specimens of not only the wild hybrid from Georgia, but also three synthetic hybrids. Although Dr. Wagner's final conclusions have not yet been published, his latest reports indicate that his studies have proved scientifically the genetic nature of *A. Gravesii* as a hybrid, which previously had been merely a hypothesis. Since these experiments, involving an accurate counting of the chromosomes at the time of meiosis, can be conducted only with living material, I consider myself fortunate in having finally discovered *A. Gravesii* in its natural state after a search extending over a period of some 17 years, and also in being able to raise six individual hybrids from spores of the parent plants, since there is always the probability under such conditions of obtaining all progeny like the parents and no hybrids.

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The Geographic Distribution of *Ceratopteris pteridoides*

CHARLES E. DEVOL

Ceratopteris pteridoides (Hook.) Hieron. has long been considered a New World fern, being listed in the 1913 Supplement of Christensen's *Index Filicum* as from Florida, Brazil, and Ecuador. It was described by Hooker from plants collected in British Guiana in 1825 and placed in the genus *Parkeria*. John Smith transferred it to *Ceratopteris* in 1841, as *C. Parkeri* J. Smith. This fern has not been reported nearly as often as it has been collected, since it has been confused with *C. thalictroides* by many.

Some authors have considered *Ceratopteris* a monotypic genus, as, for example, Christensen, who, in the *Index Filicum*, reduced all taxa to *C. thalictroides*. R. C. Benedict recognized four species and possibly others in his monograph of the genus in 1909.

Ceratopteris pteridoides differs from *C. thalictroides* in the habit of growth, in the form of the leaves, and the kind of stipe. The accompanying illustration is of a plant from Florida. It has a short fleshy stipe which is widest at the base of the leaf and tapers downward; in some plants the stipe is decidedly swollen. The leaves are broadly deltoid in outline. The sterile leaf is usually simple and has broad basal lobes, the transitional leaves are deeply pinnatifid, and the fertile leaf is finely dissected into long narrow ultimate segments. This species is usually a floating fern, although it grows equally as well or better when rooted in mud. Plants growing in our laboratory that root in the mud do not differ in form from those that float in water.

Ceratopteris thalictroides, which was described first, and which grows in many parts of the world, is much



CERATOPTERIS

FERNS OF THE ST. JOHN RIVER

Ceratopteris thalictroides, Bernh.

CERATOPTERIS THALICTROIDES FROM ST. JOHNS RIVER, FLORIDA.

better known. It has a long slender stipe; its sterile leaves are pinnately divided, narrowly oblong or ovate in outline, the ultimate lobes being narrow. This species often grows submersed, in which case the sporophylls usually stand above the water, or it may grow in wet mud with the whole plant emersed. It is never a floating fern except in its juvenile stage. The leaves vary considerably in degree of cutting, size, and relative length of stipe but are never like those of *C. pteridoides*.

The northern limit of *C. pteridoides* in the New World is about 30° N. where it grows in northeastern Florida in the St. John's River, where it was collected by A. H. Curtiss. Rapp and Uhler collected it in central Florida, near Sanford, R. P. St. John in western Florida, in Citrus County, and McFarlin in Sarasota County. It is common in the McKee Jungle Gardens, Vero Beach.

In the West Indies, Charles Wright collected it in Cuba in 1865.

In Central America it has been collected by Paul Weatherwax at least twice in Guatemala in a swamp at Quiriguá. N. C. Fassett collected it in three localities in El Salvador. Many collectors have found it in Panama, especially in the Canal Zone, among these Standley, Aviles, Shattuck, Dunn, Woodson, Allen, and Seibert.

In South America, it was collected in Colombia by E. P. Killip and Albert C. Smith, in Venezuela by A. S. Hitchcock, and in Surinam and British and French Guiana by a large number of collectors, *e.g.*, Leprieur, Jenman, Lanjouw, and Hitchcock.

It has been found in eastern Brazil by Lindman and by Luetzelburg in Bahia, and in southern Brazil by Brade in São Paulo. The two southernmost localities from which it is known are Paraguay, where Hassler collected it, and in the Chaco territory of northern Argen-

tina, where it was collected by Meyer and by Schulz. The known southern limit of the range is about 27° S.

This same fern was collected in eastern Asia by French botanists as early as 1891, but since it was always identified as *C. thalictroides*, it was never reported. I first saw it growing in Central China in the reed marshes along the north bank of the Yangtze River near Pukow,



GEOGRAPHIC DISTRIBUTION OF CERATOPTERIS THALICTROIDES.

which is the city across from Nanking. Not being acquainted with this fern, I called it *C. thalictroides* and never questioned its identity for several years until W. H. Wagner, Jr., and one or two other botanists said my drawing and description did not fit *C. thalictroides*.

The first time I saw these ferns floating in the shallow water they looked like lettuce plants, for at that time they only had the sterile leaves. Later in the season when I came past the reed marshes again, the sporophylls

had developed and the sterile leaves had nearly all died.

Mme. Tardieu-Blot, in volume 7 of *Flore Générale de l'Indo-Chine*, cites over twenty localities where *Ceratopteris* has been collected in Indo-China. I have not seen all these collections, but duplicates of most are to be found in the Gray Herbarium, Copeland's Herbarium (now placed in the University of California Herbarium), or in the Herbarium of the New York Botanical Garden. Mme. Tardieu-Blot does not distinguish between *C. thalictroides* and *C. pteridoides* and calls them both *C. thalictroides*. Her illustration on page 195 is of a fertile leaf of *C. pteridoides*. Balansa collected this fern in Tonkin in 1891; one of his specimens is in the Gray Herbarium, and another is in Copeland's Herbarium. Mouret collected this fern in Tonkin in 1906, and his collections are in the Herbarium of the Museum in Paris and the Gray Herbarium. However, many of the ferns Mme. Tardieu-Blot cites as *C. thalictroides* are correctly so named, as I have seen at least eleven of the collections she mentions from Tonkin, Annam, Cochin-China, and Cambodia that are clearly *C. thalictroides*.

While checking over the *Ceratopteris* collection at the Chicago Natural History Museum, I found a specimen of *C. pteridoides* (labelled *C. thalictroides*) collected by Sidney in 1944 in Dacca, Bengal, India (which is now a part of Eastern Pakistan).

It has been frequently noted that some plants from eastern Asia are identical with those from the eastern United States, among the better known being *Dryopteris fragrans* var. *remotiuscula*, *D. spinulosa*, *D. cristata*, *Polypodium virginianum*, *Adiantum pedatum*, *Asplenium Trichomanes*, *Osmunda regalis*, *Equisetum arvense*, *Lycopodium clavatum*, *L. lucidulum*, *L. obscurum*, and *Botrychium virginianum*. This is another fern to be added to that list. The accompanying map shows its range.

One reason why *C. pteridoides* has been confused with *C. thalictroides* is that many have assumed that the distinguishing character of *C. pteridoides* is its lack of a well-developed annulus. Lowe says, "*C. Parkeri* only differs in regard to the elastic spring of the spore case." Actually this is not a reliable character. Thompson, Bower, and others have pointed out how much these ferns vary in this character. We have had specimens growing in our laboratory that showed a wide range on the same leaf; some have had sporangia that lacked an annulus and others had a well-developed annulus. All specimens examined from eastern Asia have the annulus, whereas most specimens from Florida and South America lack the well-developed annulus; however, some specimens do have an annulus. Bauer's drawings for Hooker's *Genera Filicum* (1842) *Plate 50* shows some of the sporangia with an annulus. There is no reason to consider the plants from the Orient as belonging to a new species, nor even a distinct variety.

MARION COLLEGE, *Marion, Indiana.*

Frozen Fiddleheads

R. C. BENEDICT

The coiled beginnings of ostrich fern leaves are highly prized by the down-easter, cooked fresh in the spring, laid down in salt for later months, or canned (the canned form is even obtainable in specialty food stores). So far as I know, the quick-freezing industry has not as yet turned out packages of frozen fiddleheads.

The present note, however, is not concerned with the use of fern croziers as comestibles but with the damage done to a plot of ostrich fern plants by unusually low temperatures in the May of 1956. So far as I know, it represents the first observation of cold injury to one of our hardy species. It is offered with the thought that

others may be able to report similar injuries to this or other fern species.

It was mid-June before my annual trek to Pilot Knob, New York, could take place last year. Within a day or two I was out on a hurried inspection trip to see how some new installations had fared over winter. A plant of Goldie's fern, a transplant from the latitude of New Jersey, was found to have suffered some sort of injury that resulted in partially deformed and browned leaves. The first thought was that a fungus infection was involved, but soon neighboring plants of ostrich ferns were found even worse affected; in fact, every plant in a colony of about 200 growing near a small brook had suffered complete blasting of its first crop of leaves, which were represented by fleshy stumps a foot or more in height with the tips completely blasted. Whatever had caused the trouble had not been systemic, since each plant had thereafter developed healthy crowns of new leaves, one to two feet high, bright green, and still unrolling.

The recollection of some unusually low temperatures during the previous month, and of news notes reporting cold injury to the new shoots of hardy native trees, led to enquiry as to the date of the May cold spells and the temperatures recorded. When I asked about heavy frosts in May, I was told there had been more than frosts—heavy “freezes” was the report, with lows in the lower twenties on May 4 and May 25. Considering the size of the second growth leaves, it seemed probable that the injury had been incurred during the earlier of the “freezes.”

Two or three other points may be noted. Plants of interrupted and cinnamon ferns, growing in the same area, showed no sign of cold injury. The source of the second crop of foliage leaves cannot be stated—whether transformations of otherwise dormant ordinary leaves,

or what would normally have appeared two months later as the specialized fruiting leaves—but it can be stated that the new leaves all appeared symmetrical, and of typical foliage type.

BROOKLYN, NEW YORK.

Notes on Hawaiian Terrestrial Species of *Ophioglossum*¹

HAROLD ST. JOHN

The Hawaiian species of *Ophioglossum* have received close attention by R. T. Clausen in his monograph (1938), and in a recent special paper (1954). The present writer has studied them in the field and in the herbarium, where he has seen a large number of the specimens studied by Clausen. The present notes are offered as a further contribution to the understanding of the Hawaiian species.

OPHIOGLOSSUM NUDICAULE L. f. Clausen (1954: 493) keys *O. nudicaule* as having the rootstocks subglobose, 3.5–6.4 mm. in diameter; . . . common stalk of leaves usually less than 20 mm. long. Of the numerous specimens at hand, only about one in 30 has the rootstocks subglobose; rather the rootstocks are typically ellipsoid or narrowly so. Also the common stalk may be as much as 25 mm. long.

¹ Hawaiian Plant Studies 26. The preceding papers of this series, designed to present descriptions, revisions, and records of Hawaiian plants, have been published in Bernice P. Bishop Mus., Occ. Papers 10(4), 1933; 10(12), 1934; 11(14), 1935; 12(8), 1936; 14(8), 1938; 15(1), 1939; 15(2), 1939; 15(22), 1940; 15(28), 1940; 17(12), 1943; Calif. Acad. Sci., Proc. IV, 25 (16), 1946; Torrey Bot. Club, Bull. 72: 22–30, 1945; Lloydia 7: 265–274, 1944; Pacif. Sci. 1(1): 5–20, 1947; Brittonia 6(4): 431–449, 1949; Gray Herb., Contrib. 165: 39–42, 1947; Pacif. Sci. 3(4): 296–301, 1949; 4(4): 339–345, 1950; Bernice P. Bishop Mus., Occ. Papers 20(6), 1950; Pacif. Sci. 6(1): 30–34, 1952; 6(3): 213–255, 1952; 8(2): 140–146, 1954; Polynes. Soc., Journ. 63(1): 27–34, 1954; Bernice P. Bishop Mus., Occ. Papers 21(15), 1955; (No. 25 is in press).

OPHIOGLOSSUM NUDICAULE L. f. var. MINUS Clausen, Torrey Bot. Club, Mem. 19(2) : 148, fig. 29, 1938. Three recent collections from the Island of Hawaii, at Hawaii National Park have been made. They were found in and around steam vents near Alae Crater, 3,100 feet altitude, Chain of Craters Road, Puna District, December 18, 1954, C. Lamoureux 365, and consist of 13 plants. Of these 12 have unbranched fertile spikes; the one that is branched has the larger terminal spike damaged and not well developed, and a small normal lateral spike. The second collection at the same time and place is Earl T. Ozaki 1150. The third collection from the same steam vents near Alae Crater (Nov. 10, 1956, St. John 25973) consists of 35 plants bearing 53 fertile spikes, all of which are simple and unbranched. The specimen of this in the Bishop Museum tallies well with the account given by Clausen (1954: 496) except that none of the 19 fruiting plants shows any branching of the fertile segments. The numerous fertile segments are all simple. All of the plants but one conform to the small stature, narrow sterile blade shape, and all but one to the small size of the blade. This one has the blade 20×12 mm. and obovate-ob lanceolate. None of them has the blades ovate-orbicular to orbicular as described (p. 143-144) for *O. nudicaule* var. *nudicaule* (var. *typicum* Clausen) by Clausen in his earlier monograph. There he divides the species into seven varieties, none of which is mentioned in his 1954 paper. Since the University of Hawaii botanical expedition in December 1954 observed dozens of fruiting specimens in the hot steam cracks along the Chain of Craters, Hawaii National Park, and numerous mature fruiting plants were collected by Lamoureux, and by Ozaki, and two years later by St. John, and as all of them had the blades from elliptic to broadly ob lanceolate, it is concluded that these are not in a juvenile state, but are fully mature. Hence, the var. *minus* seems

to be a worthy taxon and the one in which this Hawaiian plant should be classed.

OPHIOGLOSSUM PETIOLATUM Hook. A specimen from Waiehu, Lahainaluna, West Maui, *W. Hillebrand & J. M. Lydgate*, is listed somewhat doubtfully by Clausen (1954: 496) as *O. nudicaule* L. f. This collection, now in the Bishop Museum, is of numerous specimens but all lack the rootstock which Clausen made diagnostic. These specimens are small, but not unusually so, and there seems no apparent reason for separating them from *O. petiolatum* Hook., which is well known on Maui, as well as on Kauai, Oahu, Lanai, and Hawaii.

OPHIOGLOSSUM CONCINNUM Brack. Clausen (1954: 495) determined a specimen from Lanai, Kamoku, *Munro 167*, as *O. concinnum*. It is here redetermined as *O. petiolatum* Hook.

Because of different interpretations of the three small, terrestrial species, the following key to them is offered.

Key to Hawaiian Terrestrial Ophioglossum

Venation of sterile blades bireticulate, with numerous smaller vein meshes within the major reticulations. *O. concinnum* Brack.

Venation of sterile blades simply reticulate.

Spikes 1–1.3 mm. wide; common stalk less than 2.5 cm. long; sterile blade 4–20 mm. long.

O. nudicaule L. var. *minus* Clausen.

Spikes 2–4 mm. wide; common stalk 2–9 cm. long; sterile blade 15–60 mm. long. *O. petiolatum* Hook.

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UNIVERSITY OF HAWAII, Honolulu 14, T.H.

Shorter Notes

THE CUT-LEAF FERN MARKET, 1957:—Two enquiries regarding the cut-leaf fern industry which have come to my attention recently led to a little fact-finding investigation. One enquirer wanted to know about the possibility of growing ferns for the market on a hundred-acre island in Puget Sound. The other, also from Washington State, was a shipper of leaves he referred to as “western sword fern”; he asked about possible chemical methods of treating the leaves at collection or packing time to avoid spoilage.

My enquiries led to a call on the Kervan Company, one of the wholesale dealers in many kinds of foliage, located in the wholesale florists’ area in W. 28th Street, New York. The first item learned was that the Washington fern, *Polystichum munitum*, is known in the New York trade as “western dagger fern,” not “sword fern,” and that this has entirely replaced any use of the Christmas fern (“eastern dagger fern”). On the second point I learned that no trouble is experienced with spoilage; the western polystichum and two others mentioned below are shipped in cold storage and kept for weeks or months. For shipment and storage, the leaves are arranged in neat bundles, 25 to 50 in each, and packed rather loosely in slatted crates that permit air circulation.

Four fern species were found in stock at Kervan’s, the eastern “fancy fern” (*Dryopteris intermedia*), the western sword fern, a specially grown species in Florida, known as “leather fern” (*Polystichum adiantiforme*, also known as *Rumohra adiantiformis*), and a fourth from California, known as “woodwardia” (*Woodwardia Chamissoi*), which is shipped by air and sold by the individual leaf. While specific wholesale prices are not reported, enough was learned to indicate that retail prices per leaf might well range from a few cents per

leaf for the dryopteris to 30 or 40 cents a leaf for the woodwardia, each about four feet long. Enough was also learned to indicate that the business of collecting and shipping fern leaves was not one to be entered into lightly.—R. C. BENEDICT.

NINETY-ONE YEARS OF BOTANICAL FIELD TRIPS:—The Field Trip Schedule of the Torrey Botanical Club, announcing its 91st season, carries on the cover page a characteristic picture of the curly grass, *Schizaea pusilla* Pursh. Inside, its first printed page is devoted to a most interesting account of this fern by David E. Fairbrothers. First found in 1805 by a group of four botanists, of whom Pursh was one, it has been the object of many special forays in the years since that time, although the second report of it was not made until 1818 when John Torrey, after whom the Torrey Club was named, found it.

The Torrey Botanical Club is worth a news note for its own sake. The oldest botanical society in the country, its Bulletin being in its 84th volume this year, the Club is devoted to two distinct phases of activity. Through its several grades of regular members (\$7.50 and higher), it has a world-wide membership among technical botanists. The Bulletin of the Torrey Botanical Club, with six issues per year, provides a medium for the publication of many pages of botanical research.

The second phase of its activities centers around its field trip program, which is devoted chiefly to the study of the flora within 100 miles of New York City. A printed schedule of these trips is published annually; this year the trips started on April 8th and will continue until Nov. 3. Most of the trips are one-day affairs but a few are for longer periods. Frequently, for a given trip, some other organization may be associated, e.g., bird study groups. In the past the Fern Society has

often been a cooperating organization. For each trip, a competent leader is assigned. Non-members of the Torrey Club are welcome to attend, but the field work is promoted primarily for a class of "associate members," who pay \$2.00 per year. Anyone interested may address the Secretary of the Club, Dr. Frank G. Lier, Department of Botany, Columbia University, New York.—R. C. BENEDICT.

Recent Fern Literature

"FERNS AND FERN ALLIES OF TEXAS,"¹ issued under a 1956 copyright by the Texas Research Foundation, is a reprinting of the text of Volume 1, part 1, of the "Flora of Texas," published in 1955 by the Southern Methodist University Press in Dallas. There are some additions and changes involved in the 1956 publication as compared with the 1955 issue. An author's preface and an introductory chapter 15 pages long have been added, and changes in makeup effected. The introductory chapter is partially adapted from Brown and Correll's "Ferns and Fern Allies of Louisiana," published in 1942, and so indicated by Dr. Correll in his preface to the new book. The textual material of the systematic treatment of the ferns and fern allies involved is identical in the 1956 publication with that of the book appearing as part of the "Flora of Texas" a year earlier.

The new issue incorporates several changes in the physical makeup of the book as compared with Vol. 1, part 1, of the "Flora of Texas." The new book is bound in sturdy boards and blue buckram instead of in paper, and has gold lettering on the front and spine. A dedication appears on page V, a pen and ink sketch of fern fronds forms a panel across the top of page VII, a table of contents and a list of illustrations have been added.

¹ By Donovan S. Correll. pp. XII + 188. *frontispiece* and 38 pls. 3 figs. 1956. Texas Research Foundation, Renner, Texas. \$5.50.

Three text figures not in the 1955 publication occur in the introductory chapter, one showing the plant zones and counties of Texas, one shows leaf outlines and types of marginal serrations and toothings together with other parts of plant structures, and the third is a schematic representation of the life cycle of *Pellaea atropurpurea*.

In the "Flora of Texas" issue, there were 39 plates bound at the end of the text, with explanations of the figures printed on the facing pages. In contrast, the new book has plate 13 of the earlier work, depicting *Adiantum capillus-veneris* and *A. tricholepis*, shifted to the frontispiece, and the other plates (38 in all) distributed conveniently through the text. Plate 1 appears on page 19 and is one of the four plates devoted exclusively to a single species. Each of the remaining 34 plates represents two or more species among its figures. All of the drawings are well executed and, with the exception of text-figure 2, are the work of Miss Jane W. Roller, of the U. S. Forest Service.

The keys and descriptions have been written carefully, references to the original publication of each accepted species and to much of the synonymy have been provided, and additional references to works in which the accepted binomial has been used subsequent to its first publication serve as a guide to other literature dealing with the species. Habitat requirements of the species and a general statement of the range within and outside Texas, and citation of specimens are given. Comments dealing with various, and often important, features of the plant, its distribution, taxonomic status, or misconceptions about it are appended in a large majority of the species accounts. These comments add considerably to the interest and general usefulness of the book.

This re-issue provides fern lovers with an attractive book, and the author's introductory chapter furnishes interesting and valuable information about the floristic

regions of Texas, a glance at the botanical history of the Lone Star State, a brief introduction to the ecology of ferns in Texas, some notes regarding the horticulture of certain species, and a few paragraphs about the economic uses of ferns.

The retail price of Vol. 1, part 1, of the "Flora of Texas" is \$5.00, that of the "Ferns and Fern Allies of Texas" \$5.50. At such reasonable prices one probably should not feel piqued if, after purchasing the 1956 book, he learns that he already had the first issue of the text in his library! One or the other of these books should be in the possession of anyone interested in the ferns of the southwestern United States.—IRA L. WIGGINS, *Stanford University*.

"THE MORPHOLOGICAL AND CYTOLOGICAL DISTINCTNESS OF BOTRYCHUM MINGANENSE AND B. LUNARIA IN MICHIGAN," by W. H. Wagner, Jr., and Lois P. Lord,¹ presents convincing evidence that *B. minganense* ought to be considered a species distinct from *B. Lunaria* rather than a variety or merely a form, as it has sometimes been thought to be. The differences extend throughout the morphology of the plant, but are rather subtle and are more easily seen in living than in herbarium material. It is perhaps desirable that these distinctions be summarized here for the benefit of those to whom the original paper is not available. In color, *B. minganense* is yellowish green and *B. Lunaria* is a true light green, a difference that persists somewhat even in dried material. The sterile blade of *minganense* is somewhat persistently trough-shaped, the pinnae being folded together and embracing the base of the fertile segment, whereas in *Lunaria* the segments are flat except in the earliest part of the growing season. The angle between the upper and lower margins of the pinnae is broad in *Lunaria* (100° – 190° , aver. 150°) and narrower in *minganense* (40° – 150° , aver. 90°), i.e. the

¹ Bull. Torrey Bot. Club 83: 261–280. fig. 1–5. 1956.

pinnae of *minganense* are more narrowly cuneate at base. In *Lunaria* the lower margin of the lower pinnae is descending, and in *minganense* it is spreading or ascending. The sterile blades are rather gradually reduced at the apex in *minganense* and abruptly reduced in *Lunaria*. Some slight differences in the leaf-primordia are illustrated by Wagner (fig. 5). As has been known previously, the spores of *minganense* are measurably larger, averaging $36\ \mu$ in diameter, compared with $29.8\ \mu$ in *Lunaria*. Wagner has shown that although *minganense* is a tetraploid ($n = 90$) (*Lunaria* $n = 45$) there is no clear evidence of hybrid origin. The range of *minganense* is Labrador, Quebec, Ontario, Vermont, New York, Michigan, Wisconsin, Utah, Idaho, Montana, Alberta, British Columbia, and Alaska; California records appear to refer to forms that are best referred tentatively to *B. Lunaria*, although they may represent a recognizable geographic subspecies. Wagner also shows that although *B. onondagense* Underw., originally described as a species and subsequently considered as a variety or form of *B. Lunaria*, approaches *minganense* in some respects it is really only an edaphic form of *Lunaria*, a shade-form. An incidental record in this paper is a report of the chromosome number of *B. matricariifolium* in Emmet County, Michigan, which is also tetraploid ($n = 90$).—C. V. MORTON.

Notes and News

OUR NEW VICE-PRESIDENT.—The vacancy in the Council of the American Fern Society caused by the death of the Vice-President, Harold G. Rugg, has been filled by action of the Council. Dr. Benjamin R. Allison, 26 Ives Road, Hewlett, Long Island, New York, has been appointed to fill out the unexpired term. Dr. Allison, who has been a member since 1950, has been active in organizing meetings and field-trips in the New England area. We welcome him to the Council.

AAAS REPRESENTATIVE.—The American Association for the Advancement of Science has recently changed the status of the American Fern Society from that of "Associated Society" to "Affiliated Society," which entitles the American Fern Society to appoint one Representative to the Council of the American Association for the Advancement of Science. Our Council has appointed Dr. A. C. Smith, National Science Foundation, Washington 25, D. C., to serve as the Representative. The AAAS has done good work in organizing American scientists.

VERMONT FIELD-TRIP.—A midsummer outing is planned for the neighborhood of Rutland, Vermont, on July 12, 13, and 14. Areas to be visited include Ludlow, Sugar Hollow, and Lake Dunmore. Arrangements are being made by Dr. Benjamin R. Allison, Hewlett, L. I., New York.

ANNUAL MEETING AND FIELD-TRIP IN CALIFORNIA.—The Annual Meeting will be August 26 or 27, at Stanford University. The preceding field-trip will begin at Stanford University on August 21, according to present plans, and will be up the Redwood Highway into the northern Coast Ranges and the northern California coast. Arrangements are being made by Dr. Ira L. Wiggins, Dudley Herbarium, Stanford University, California.

Our new member Miss Eva Alexander (900 Graymont Avenue West, Birmingham, Alabama) has recently received spores of *Adiantum aethiopicum*, which must be rare in cultivation. She will perhaps be able to supply a few to those interested.—C. V. M.

A picture of Mount Fujiyama on a Christmas card brought the thought that fern hunting on its slopes would be intriguing. It came from Tomitaro Namegata, of the "Japanese Fernist Club." Our greetings go to our fellow Japanese fern hobbyists.—R. C. B.

American Fern Society

REPORT ON THE GASPÉ FIELD-TRIP.—Fern Society members attending the annual field-trip met at the Chateau Frontenac, Quebec, on Sunday, Aug. 19, 1956. The formal start was made the next morning from the Quebec Bridge. There were eight cars in the caravan, and we spent the day in a leisurely drive through the picturesque Quebec countryside to Rimouski, a distance of 187 miles, passing en route the famous collecting locality of Bic.

Tuesday, August 21, we proceeded to the lodge at the foot of Mount Albert, in Gaspé National Park. The center of the Gaspé Peninsula is dominated by a mountain range, in which Mount Albert (3775 feet) and Mount Jacques Cartier (4230 feet) are the principal summits. These mountains, although not high by ordinary standards, are especially interesting botanically. The lower slopes are covered densely by evergreen forests of black and white spruces and balsam fir, and arbor-vitae is sometimes prominent. The forest floors are covered thickly by a dense carpet of mosses of the feathered type. The commonest ferns are *Dryopteris austriaca*, *Thelypteris Phegopteris*, *Cystopteris fragilis*, *Gymnocarpium Dryopteris*, *Athyrium Filix-femina* var. *Michauxii*, and *Osmunda Claytoniana*, with *Polypodium vulgare* var. *virginianum* abundant on the rocks, and *Asplenium viride* not uncommon. Ordinarily, *Equisetum pratense* is a rarity, but here it was common along the banks of the St. Anne River.

Wednesday, August 22, was devoted to a climb of Mount Albert, which is not difficult as mountains go. It is the kind of mountain that is called a "tabletop," or a "mesa" in the West—steep slopes all around and a large, flat area at the top. In spite of the relatively low elevation one rises above timberline about a thousand feet below the summit of Mount Albert, an indication of the

rigorous climatic conditions that prevail. The top of Mount Albert is perhaps the southernmost outpost of the truly Arctic flora. Due to poor drainage, frost action is intense in late fall and early spring, and conditions are identical to those found in the Arctic tundra. The summit is thus a remarkable refuge for those plants that can adapt themselves to the adverse conditions. At first sight, it appears devoid of vegetation, but a careful examination shows an abundance of species, mostly minute cushion-plants and trailing shrubs. Near the summit, the members of the Fern Society foray were particularly pleased to find *Adiantum pedatum* var. *aleuticum*, the rare, Arctic variant of the maidenhair fern; it was strange to see its dwarf, bluish, strictly erect fronds growing in the full sunshine along with grasses—a decided contrast to the lax, green, shade-loving maidenhair fern that we all knew so well from lowland woods. Transplant experiments with this Arctic form would be interesting, to see if it would maintain its character under different climatic conditions. Most of the plants from the Pacific States that have been called var. *aleuticum* are only more or less typical *pedatum*, but the true *aleuticum* does occur there sparingly on some of the higher mountains.

Thursday, August 23, was spent in the scenic drive along the northern coast of the Gaspé Peninsula from Mount Albert to Percé, a distance of 177 miles over a very fine new highway. This north coast is rugged and highly picturesque, and cameras were in full use during the day; the climate is rigorous and Arctic elements in the flora are present even at sea-level.

Friday, August 24, was devoted to a trip in the morning to Bonaventure Island, a bird sanctuary famous for the large numbers of sea-birds, especially the graceful, gull-like gannets, which were present by the thousands. The afternoon was spent in a climb of Mont Sainte Anne,



SOME OF THE MEMBERS OF GASPÉ FIELD-TRIP: LOWER ROW, LEFT TO RIGHT: A. V. SMITH, DORCAS BROWN, DORIS MCCLINTOCK, C. V. MORTON, WILLIAM COOK, MURIEL BROWN, MARCEL GOUGEON; MIDDLE ROW: JEWEL MOORE, SARAH BROWN, LAURA EAST, MASTER RHODES, MARY WALKER; TOP ROW: HELEN JOHNSON, INEZ HARTSOE, AMANDA WILLIAMSON, ANNA SCUDDER, ROBERT GLASGOW, MRS. LORD, MRS. GLASGOW, ARTHUR LORD, MARION RHODES.

near Percé. A picturesque little grotto with a waterfall had beautiful specimens of bulblet-fern and some *Cryptogramma Stelleri*, and the little rivulet nearby had large clumps of ostrich fern and male fern, the latter rare in this part of the world. The summit is the habitat of *Botrychium Lunaria*, and a careful search on hands and knees by numerous members of the party turned up a few plants.

Saturday, August 25, the party officially broke up. Some remained at Percé for a longer stay, others returned to Quebec, and most travelled southwestward along the southern coast of Gaspé, on the road back to the United States. This southern coast is quite different from the northern, being flat and sandy. At the south is the Baie des Chaleurs, and as the name indicates the general climate here is decidedly warmer than elsewhere in Gaspé. Some southern plants reach their northern limit here.

Altogether, there were about 31 in the party, among them Dr. and Mrs. Clair Brown, Muriel Brown, Dr. and Mrs. William S. Cook, Laura East, Mr. and Mrs. Robert Glasgow, Inez Hartsoe, Helen Johnson, Charlotte Learned, Mr. and Mrs. Arthur Lord, Jewel Moore, C. V. Morton, Marion Rhodes, Hester Rusk, Dr. A. V. Smith, Anna Scudder, Eva Sobol, Mary Walker, Elsie Whitney, and Amanda Williamson. The party was led most capably by Marcel Raymond and James Kucyniak, of the Montreal Botanical Garden. Raymond and Kucyniak made a scouting trip over the route about two weeks prior to the foray, and wrote up a detailed prospectus that was handed to each participant. A part of the account given above is adapted from this prospectus. The sincere thanks of the Fern Society go to the Montreal Botanical Garden for sponsoring the trip.—C. V. MORTON.

NEW MEMBERS

Coleman, Mrs. Stewart P., Barrett Road, Cedarhurst, L. I., New York

Cook, Prof. William S., Dept. of Botany, Louisiana State University, Baton Rouge, La.

Fisher, Mrs. Morris, Route 1, Worden, Montana

Fuchs, Hans Peter, Höhe 810, Köllichen (AG.), Switzerland

Grunden, Mrs. Wayne, 5 Crane Road, Mountain Lakes, N. J.

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Lengel, Miss Patricia A., Dept. of Biology, College of Wooster, Ohio

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American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

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No. 3

Ponga Ware¹

ROBERT COOPER

The cover photograph shows a short length of the stem of a New Zealand tree fern, *Cyathea medullaris* Sw. The trunk of the tree fern is usually covered with matted fibers in the lower part, and marked higher up with the scars of fallen fronds and the bases of old fronds. In the specimen illustrated the fibers have been cut away exposing the vascular supply to the leaves and roots, and the central pith has been removed. The specimen was sent to the Missouri Botanical Garden by Mr. H. J. Dentzman of St. Louis, who received it from Mr. G. L. Miller of Te Awamutu, New Zealand.

Quite handsome pots and garden ornaments are made from the whole trunk which may attain a diameter of two feet or more at the base. Turning these is dirty work, however, and very hard on the tools. The broken fibers are very popular in orchid culture. The whole trunks are used for garden paths, holding banks, garden drain-pipes, ornamental fences and fern-houses. New shoots may arise from the cut stems and add to the beauty of the structure.

Stems which have been cleaned and bleached are made into vases, powder-bowls, and ash-trays. One of my associates on making inquiries found that *Cyathea medullaris* is the species used. Turning must be done while the trunk is still green. The soft central pith is then scraped out and the article is left to cure (the white ground tissue shrinks away from the hard black masses of fibers). Methods of curing and bleaching are carefully guarded trade secrets. The dried stem will not hold water so an iron or glass container is fitted in the center. Usually the outer surface is polished and varnished, and the finished vase, ash-tray, or powder-bowl sells for two to three dollars or more. Unfortunately, there seems to be only one manufacturer, and as he had not been to town for some time my associate was unable to send me any specimens of his wares.

¹ Reprinted from the Bulletin of the Missouri Botanical Garden, Vol. 41, No. 2, pp. 29, 30. 1953.
[Volume 47, No. 2, of the JOURNAL, pp. 49-88, was issued June 18, 1957.]



PONGA WARE VASE MADE FROM TREE-FERN TRUNK

Cyathea medullaris, better known perhaps as the Black Tree Fern, Black Ponga, or Mamaku, is one of the largest and most imposing of the tree ferns. Its trunk reaches 50 or more feet in height, bearing a crown of spreading fronds at times as much as 20 feet long. The strong, bright green leaves are borne on glistening black stalks. Dobbie, an ardent New Zealand pteridologist and author of a very popular book on New Zealand ferns, found the average daily growth of the fronds to be 2 inches, and the greatest daily growth to be 4 inches. He considered that the stems did not grow more than a foot in height each year.

The first European botanists to collect specimens of this tree fern were John Reinhold Forster and his son George Forster, who accompanied Captain James Cook on his second voyage to the South Seas in the years 1772-1775. The plant was described in 1786 as *Polypodium medullare* by George Forster in an attractive little book entitled "De Plantis Esculentis Insularum Oceani Australis Commentatio Botanica" in which details of 54 edible plants are given. Forster applied the specific name "medullare" in reference to the fact that the pith tissues of the stem consist of a mealy substance, resembling sago, which was used by the Maori for food. It was quite palatable, after being cooked in an oven, and possibly took the place of potatoes when roasted slave or enemy was served as the main dish. The aborigines of southeast Australia also used the pith of *C. medullaris* for food, and the natives of New Caledonia ate the pith of an allied species, *C. Vieillardii* Mett.

The American fern usually known as *Dryopteris paleacea*

A. H. G. ALSTON

The name *Dryopteris paleacea* (Swartz) C. Chr. (1911) based on a Peruvian plant is illegitimate, being a later homonym of *Dryopteris paleacea* (D. Don) Hand.-Mazz. (1908), which is based on a plant from Nepal. The Asiatic plant, for which the correct specific name is *Dryopteris Wallichiana* (Spreng.) Hyl. (2), differs from the American by having black, not reddish-brown, scales. The American plant is, therefore, left without a valid specific name. The correct name should be:

DRYOPTERIS parallelogramma (Kunze) Alston, *comb. nov.*

Aspidium paleaceum Swartz, Syn. Fil. 52. 1806.

Aspidium parallelogrammum Kunze, Linnaea **13**: 146. 1839.

Dryopteris paleacea C. Chr. Amer. Fern Journ. **1**: 94. 1911, non Hand.-Mazz. (1908). *Nom. illegit.*

The species ranges from Mexico to Argentina. Rothmaler (3) has recently separated from it *D. pseudo-filix-mas* (Fée) Rothm. and *D. × chrysocarpa* (Fée) Rothm. This latter is regarded as a hybrid between the two foregoing species; both are from Mexico. The European plant is nearer to the American than the Asiatic, but the name *D. Borreri* Newm., which applies to it, dates only from 1854 and it would accordingly have to take the name *D. parallelogramma* if the two were united.

The synonymy of the Asiatic species is as follows:

Dryopteris Wallichiana (Spreng.) Hyl. in Bot. Notiser 1953: 352; Alston & Bonner, Candollea **15**: 216. 1956.

Aspidium paleaceum D. Don, Prodr. Fl. Nepal. 4. 1825, non Swartz (1806).

Aspidium Wallichianum Spreng. Syst. Veg. **4**: 104. 1827.

Aspidium Donianum Spreng. *op. cit.* **4**: Suppl. 320. 1827.

Dryopteris paleacea Hand.-Mazz., Verh. Zool.-Bot. Ges. Wien **58**: 100. 1908, *nom. illegit.*

D. Doniana (Spreng.) Ching in Sunyatsenia **6**: 3. 1941.

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BRITISH MUSEUM, LONDON, ENGLAND.

Which Northeastern Ferns are Evergreen?

EDGAR T. WHERRY

Horticulturists who are planning fern gardens for winter effect or considering the use of ferns for retarding erosion on shaded slopes need authentic information as to which species are evergreen and which are not. Finding that a number of statements in several recent "popular" fern books are at variance with my own observations over the past 40 years, I have compiled the following lists. However, it seems that correct statements never quite catch up with erroneous ones, and for years to come writers who merely copy uncritically will probably list deciduous species as evergreen or the reverse, because "it says so in such and such a book."

Anyway, here are my data for latitudes 39° to 43°. The 115 species included are arranged alphabetically under widely used technical epithets. For simplicity, assignment of any of them to varietal status under another is avoided. Hybrids are not covered. Reports of experiences of others that do not agree with mine will be welcome.

I. STERILE AND FERTILE FRONDS OR LEAVES ESSENTIALLY ALIKE

1. BOTH STERILE AND FERTILE FRONDS OR LEAVES EVERGREEN

<i>Asplenium bradleyi</i>	<i>Isoëtes</i> spp.
<i>cryptolepis</i>	<i>Lycopodium lucidulum</i>
<i>montanum</i>	<i>selago</i>
<i>pinnatifidum</i>	<i>Phyllitis scolopendrium</i>
<i>resiliens</i>	<i>Polypodium polypodioides</i>
<i>trichomanes</i>	<i>virginianum</i>
<i>Camptosorus rhizophyllus</i>	<i>Polystichum acrostichoides</i>
<i>Dryopteris celsa</i>	<i>braunii</i>
<i>fragrans</i>	<i>lonchitis</i>
<i>intermedia</i>	<i>scopulinum</i>
<i>marginalis</i>	<i>Trichomanes boschianum</i>

2. STERILE FRONDS EVERGREEN, FERTILE DECIDUOUS OR MARCESCENT

<i>Adiantum capillus-veneris</i>	<i>Dryopteris clintoniana</i>
<i>Asplenium platyneuron</i>	<i>cristata</i>
<i>viride</i>	<i>flix-mas</i>
<i>Cheilanthes alabamensis</i>	<i>spinulosa</i>
<i>feeii</i>	<i>Pellaea atropurpurea</i>
<i>lanosa</i>	<i>glabella</i>
<i>tomentosa</i>	<i>Woodsia obtusa</i>

II. STERILE AND FERTILE FRONDS OR SEGMENTS DISSIMILAR

3. STERILE FRONDS, STEMS, OR SEGMENTS EVERGREEN, FERTILE NOT

<i>Botrychium dissectum</i>	<i>Lycopodium flabelliforme</i>
<i>multifidum</i>	<i>obscurum</i>
<i>obliquum</i>	<i>sabinaefolium</i>
<i>Equisetum hyemale s.l.¹</i>	<i>sitchense</i>
<i>scirpoides</i>	<i>tristachyum</i>
<i>variegatum</i>	<i>Lygodium palmatum</i>
<i>Lycopodium alpinum</i>	<i>Selaginella apoda</i>
<i>annotinum</i>	<i>rupestris</i>
<i>clavatum</i>	<i>selaginoides</i>
<i>complanatum</i>	

4. FERTILE FRONDS MARCESCENT-PERSISTENT, STERILE DECIDUOUS

<i>Matteuccia pensylvanica</i>	<i>Schizaea pusilla</i>
<i>Onoclea sensibilis</i>	(sterile subevergreen)

III. ALL FRONDS, LEAVES, OR SEGMENTS DECIDUOUS

<i>Adiantum pedatum</i>	<i>Lycopodium adpressum</i>
<i>Athyrium alpestre</i>	<i>alopecuroides</i>
<i>flix-femina s.l.</i>	<i>carolinianum</i>
<i>pycnocarpon</i>	<i>inundatum</i>
<i>thelypteroides</i>	<i>Marsilea mucronata</i>
<i>Azolla caroliniana</i>	<i>Notholaena dealbata</i>
<i>Botrychium lanceolatum s.l.</i>	<i>Ophioglossum engelmannii</i>
<i>lunaria</i>	<i>vulgatum</i>
<i>matricariaefolium</i>	<i>Osmunda cinnamomea</i>
<i>minganense</i>	<i>claytoniana</i>
<i>simplex s.l.</i>	<i>regalis</i>
<i>virginianum</i>	<i>Pteridium latiusculum</i>
<i>Cheilanthes siliquosa</i>	<i>Thelypteris dryopteris</i>
<i>Cryptogramma acrostichoides</i>	<i>hexagonoptera</i>

¹ "s.l." = *sensu lato*, that is, in a comprehensive sense.

<i>Cryptogramma stelleri</i>	<i>Thelypteris noveboracensis</i>
<i>Cystopteris bulbifera</i>	<i>palustris</i>
<i>fragilis</i> s.l.	<i>phegopteris</i>
<i>montana</i>	<i>robertiana</i>
<i>Dennstaedtia punctilobula</i>	<i>simulata</i>
<i>Dryopteris campyloptera</i>	<i>Woodsia alpina</i>
<i>goldiana</i>	<i>appalachiana</i>
<i>Equisetum arvense</i>	<i>cathecartiana</i>
<i>fluviatile</i>	<i>glabella</i>
<i>kansanum</i>	<i>ilvensis</i>
<i>laevigatum</i>	<i>oregana</i>
<i>palustre</i>	<i>scopulina</i>
<i>pratense</i>	<i>Woodwardia areolata</i>
<i>sylvaticum</i>	<i>virginica</i>

BOTANICAL LABORATORIES, UNIVERSITY OF PENNSYLVANIA.

A Method of Preparing Spores for Fern Cultures

WALTER F. KLEINSCHMIDT

In growing ferns from spores, it is desirable, and in experimental work essential, to be able to obtain pure cultures of one species. For example, much time might be wasted in carefully growing plants which later turn out to be contaminants. For controlled experiments, contaminating spores of other species may give uncertain results and threaten the validity of the work. Not only are mixtures of spores of other fern species an inconvenience, but spores of mosses, algae, and fungi are likewise troublesome. Often cultures become overgrown with the filamentous protonemata of mosses that shade out the desired fern prothallia. Algae, especially the green and blue-green types, may often "take over," enveloping the fern material, killing both prothallia and young sporophytes. Mold fungi also are serious pests that handicap culture work.

To allay such contamination, many who grow fern spores are careful to sterilize their culture medium, whether it be soil, nutrient agar, or liquid solution, as

well as to sterilize the containers. In my own work I have always tried to do this. But recently it occurred to me that much of our contamination probably arises from the original source of spores, the leaf and the sori from which the spores are originally obtained. How many of the contaminating spores enter the cultures from the surfaces of the leaves we use as our spore sources? If all the vessels and media used are sterilized, then the contaminants must be carried with the spores when they are first removed from the sori. This is especially true of plants collected in the field where several species of ferns, mosses, algae, and fungi all grow together in a locality, or if they are placed together in the same container when collected. It would be no less true, however, of ferns grown together in a greenhouse where spores may be discharged from a variety of plants simultaneously. How, then, can contamination be eliminated at the time of removing the spores from a fern leaf? The method I wish to describe here essentially involves removing and/or killing the contaminating spores before the desired spores are discharged.

In selecting the fertile leaf or pinnae, whether in the field or in the greenhouse, the suggestions I made earlier should be followed.¹ It is best to choose a leaf blade on which at least some of the sporangia are still young and undeveloped and the sori appear tan in color (rather than whitish or dark-brown). Even though a leaf may appear very fruitful, it may be that the fully mature sporangia which "fill up" the sori have actually opened and discharged their spores. If specimens which have been already dried and pressed are used, the same general principles apply.

For decontaminating a specimen, a sterilizing solution of commercial "Chlorox" (sodium hypochlorite) is used. The concentration should be approximately 5-10%

¹ Kleinschmidt, W. F. 1952. Growing ferns from spores. *This JOURNAL* 42 (no. 4): 117-124.

Chlorox in water. This solution alone is not adequate, however; the problem of wetting the surfaces (whether of living or already dried leaves) is also involved, and unless the surfaces in their entirety are covered by the sterilizing agent, the effectiveness of treatment is greatly diminished. For this reason, I have found it desirable to add a wetting agent. In my experiments I have found the commercial product "Tween 20," to be entirely suitable. I make it up at approximately the ratio of 1 part wetting agent to 2000 parts "Chlorox" solution.

The leaf or leaflet from which spores are to be removed is immersed in the sterilizing solution for 5 to 10 seconds. At the same time it is important to remove all the air bubbles. One can accomplish this by actively rubbing both sides of the blade with a small brush. As soon as the specimen has been exposed to the "Chlorox" solution for sufficient time, it can be taken out and put directly in a fresh envelope in a clean paper tablet. (The envelopes and tablet may be dry-sterilized by heating beforehand in a box in a dry, hot oven.) The cheaper the tablet the better for this purpose: coarse papers tend to act like a towel or blotter. I put the envelopes in the tablet at intervals of 5 or 6 pages, and put a weight on top.

The simple treatment which I have described seems to kill all the free spores attached to the leaf surfaces. Those spores that remained in unopened sporangia during the treatment are unaffected, however, and when the material is dried in the envelopes, these unopened sporangia will now expand and release their spores. The actual drying of the specimen after "Chlorox" treatment requires no more than two or three days at most, and, if necessary, the envelopes containing the specimens may be transferred to other pre-dried tablets to hasten their drying. The spore-producing leaves themselves, however, should *never* be exposed to artificial heat directly

or the spores will be killed.

After the specimens are thoroughly dried, they may be kept this way in the covering envelopes until time for use. The spores, now scattered in the envelopes, may also be sown directly by tapping them on the medium in a room where there is no air circulation. A sterile teasing needle (flamed over an alcohol lamp and cooled) or narrow scalpel is helpful to broadcast the spores from the envelope into the culture dishes.

I believe this technique may be of value to those attempting to prepare pure cultures of fern spores. By using this method, there is far greater assurance of purity of spores from the beginning. I have tried the technique on a number of fern genera (*Cyclosorus*, *Woodsia*, *Cyrtomium*, *Pteris*, and others), sowing the uncontaminated spores on nutrient agar in test tubes. So far as it has been possible to determine, the cultures which resulted by this method were entirely pure.

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Ferns of Oregon Caves National Monument and Vicinity

WILLIAM H. BAKER AND GEORGE C. RUHLE

Oregon Caves National Monument and vicinity comprise an area of approximately 6,000 acres, in the Siskiyou Mountains, in or near T40S, R6W, Josephine County, Oregon. The monument includes about 480 acres and the balance of the acreage is within the Oregon Caves Game Refuge. This locality is situated from 15 to 20 miles south of Grants Pass and 6 to 11 miles north of the Oregon-California boundary in southwestern Oregon. It consists of the entire Lake Creek-Cave Creek drainage basin and embraces Sandstone Ridge to the summit of Grayback Mountain at 7,043 feet, the Limestone Creek-Sucker Creek trail to the mouth of Cave Creek at 1,800

feet, and the trail eastward along Grayback Creek. All of the streams flow into the Illinois-Rogue River drainage system.

The area is part of the Siskiyou Mountains, a complex geological region, which in turn is a part of the Klamath-Siskiyou province. It extends inland from the Pacific Ocean 100 miles and in a north and south direction from the Coquille River to the Mad River in California. This is the oldest landmass in the coastal region, existing since Paleozoic time mostly as an island and possibly at times as a peninsula connected by a narrow neck to the mainland. The system has undergone a long complicated history of mountain building, peneplanation, igneous intrusion, and glaciation. As a result of this complexity with concomitant extensive dissection, the country is extremely broken, presenting a confusion of sharp ridges with steep stony slopes averaging more than 30 degrees.

The rocks of the area are metamorphosed sedimentaries and volcanics of Jurassic age or older. In general, they have a steep dip and a northerly or northeasterly strike. The eastern more elevated portion of the area studied is a small part of a great batholithic stock of quartz-diorite that probably underlies a large territory. This stock shows marked and extensive contact metamorphism along its edges. The meta-sedimentary rocks consist of altered tuffaceous sediments, argillites, limestones and quartzites. The meta-volcanics west of the contact aureoles are altered lava flows and pyroclastics with some intrusives and are in part injected with serpentines. Jurassic and older sediments and volcanics occur at lower elevations along Cave and Sucker Creeks. They include dark-colored slates and altered andesitic flows.

There are limited areas of serpentine outcrops and soils that support a singularly characteristic and unusual flora which is made up of quite a number of endemic species. Most of the soil is residual, scanty and markedly

pervious to moisture. The region above 5,000 feet is sculptured by glaciation. Due to its antiquity, the entire province is biologically significant. Vegetation zones range from humid to arid transition and at the higher altitudes the boreal zones are all represented.

Although the rainfall averages over 40 inches a year, most of the precipitation occurs outside the regular growing season. The summer months are hot and dry. This fact, coupled with a scanty pervious soil, produces xerophytic conditions which do not generally contribute to a luxuriant growth of ferns. However, there are mesic and even hydric local habitats present which provide favorable sites for ferns to grow, such as deep cool coniferous forests, the shores of lakes, streamsides, edges of springs, and rocky cliffs and talus slopes below snowbanks that do not melt until late in the season.

Specimens were collected during the seasons of 1949 and 1950. All of the numbers cited in the text were collected by the authors. Duplicates have been deposited in the Herbarium of the University of Idaho and in the Herbarium at Crater Lake National Park Headquarters.

Probably the most complete collection of plants previously obtained at Oregon Caves was made by the late Elmer C. Applegate, while a ranger-naturalist at Crater Lake National Park. His specimens are deposited in the Dudley Herbarium at Stanford University. Among other botanists who have collected in the area are Dr. Morton E. Peck of Willamette University, Dr. Leroy E. Detling of the University of Oregon, and Dr. Robert H. Whitaker, who has deposited his collection at the Herbarium of the State College of Washington. Without doubt, a number of other persons have made collections here, as the region is one of considerable interest in that it harbors a rich and varied flora containing numerous endemics.

OPHIOGLOSSACEAE

BOTRYCHIUM MULTIFIDUM (Gmel.) Rupr. ssp. *SILAIFOLIUM*

(Presl.) Clausen. Leathery grape-fern. Small mossy flat at the outlet of Upper Biglow Lake, along the shore line (nos. 668, 719); rare. Duplicate identified by Dr. Robert T. Clausen.

POLYPODIACEAE

CYSTOPTERIS FRAGILIS (L.) Bernh. Bladder-fern. Dry open woods on Sand Ridge (nos. 29, 39); open woods on Lake Mountain (no. 348); growing on rock slides at Lower Biglow Lake (no. 425); fairly common.

POLYSTICHUM LONCHITIS (L.) Roth. Holly-fern. Abundant on rock ledges above Upper Biglow Lake (no. 706).

POLYSTICHUM MUNITUM (Kaulf.) Presl. Common sword-fern. Growing along the Big Tree trail at Cave Creek (nos. 513, 519); one of the commonest ferns in the area.

POLYSTICHUM MUNITUM (Kaulf.) Presl var. *IMBRICANS* (D. C. Eaton) Maxon. Imbricated sword-fern. Along the No Name trail (no. 456); growing on a moist cliff at the Caves, edge of Cave Creek (no. 555); fairly common.

POLYSTICHUM SCOPULINUM (D. C. Eaton) Maxon. Eaton's shield-fern. On dry rocky cliffs, Sand Ridge (no. 38); also in rock crevices at the summit of Lake Mountain (no. 352); not common.

DRYOPTERIS DILATATA (Hoffm.) A. Gray. Spreading wood-fern. Along the Big Tree trail at Cave Creek (no. 521); growing on a rocky hillside at Lower Biglow Lake (no. 592); not common.

ATHYRIUM FILIX-FEMINA (L.) Roth. Lady-fern. On a rock slide at Lower Biglow Lake (no. 425); along the Big Tree trail at Cave Creek (nos. 520, 549); along the Grayback trail (no. 682); common along trailsides and streams.

ADIANTUM PEDATUM L. Western maidenhair. Fairly common along stream margins, Grayback trail (no. 150).

PTERIDIUM AQUILINUM (L.) Kuhn var. *PUBESCENS* Underwood. Western bracken. Along the Big Tree trail at Cave Creek (no. 522); open meadow, east slope of Lake Mountain (no. 898); very common.

CHEILANTHES GRACILLIMA D. C. Eaton. Lace-fern. Summit of Lake Mountain (nos. 175, 333); common.

CHEILANTHES SILIQUOSA Maxon. Oregon cliff-brake. Rocky crevices along the Grayback trail, upper ridges (no. 144); summit of Mt. Eliza (no. 579); occasional.

CRYPTOGRAMMA ACROSTICHOIDES R. Br. American parsley-fern. Common on summit of Lake Mountain and on the rock slides above Upper and Lower Biglow Lakes (nos. 235, 414, 487, 614).

EQUISETACEAE

EQUISETUM HYEMALE L. Scouring rush. Growing along the edge of lower Cave Creek (no. 853).

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Observations on Cultivated Ferns, III. The Species of *Microlepia*

C. V. MORTON

The genus *Microlepia* is not common in cultivation in the United States generally, because all the species are tropical or subtropical, and consequently are strictly greenhouse plants except in southern California and Florida. They are ornamental plants, large and leafy, resembling other large ferns such as *Dryopteris*, *Polystichum* and *Athyrium*, but they are not really at all allied to these. One obvious distinction is that these genera mentioned, of the dryopteroid type, all have conspicuous flattened chaffy scales on the rhizomes and usually also on the stipes and rhachises. There are no scales in *Microlepia*, only abundant septate hairs. The most closely allied is genus is *Dennstaedtia*, which has similar hairs and differs chiefly in the technical character of the sorus, which is strictly marginal in *Dennstaedtia* and inframarginal in *Microlepia*; this causes a corresponding difference in the shape of the indusium, which is cup-shaped in *Dennstaedtia* and half-cup-shaped in *Microlepia*.

The following key will separate the species that are known to be in cultivation.

KEY TO THE SPECIES

Plants large and coarse, pinnate-pinnatifid or bipinnate at base, the ultimate segments lanceolate, acuminate; rhachis and segments glabrous at maturity; indusium whitish, opaque, more or less plane, broad, attached at the base, ca. 1.5 mm. wide; receptacle transversely elongate, about 1 mm. wide

M. platyphylla

Plants smaller or more delicate, bipinnate to quadripinnate, the ultimate segments shorter, blunter; rhachis and segments hairy beneath; indusium yellowish-hyaline, half-cup-shaped, about 0.75 mm. wide; receptacle subspherical, about 0.3 mm. wide.

Veins (at least in dried material) not raised above the surface beneath; hairs of rhachises and midribs fine, horizontally spreading; blades tripinnate to quadripinnate.

M. speluncae

Veins (at least in dried material) prominently raised on the lower surface; hairs of rhachises and midribs coarse, mostly upwardly directed toward the apex of the blade or pinnae.

Rhachises and midribs above more or less hairy, with some minute hairs extending to the leaf surfaces above (i.e. on the surfaces opposite from the sori); blades mostly tripinnate, the lower pinnae usually 8 cm. broad or more.

M. firma

Rhachises and midribs glabrous or glabrescent above, the hairs on the segments above, if any, confined to the veins; blades mostly bipinnate or bipinnate-pinnatifid, the pinnae mostly 5 cm. wide or less.

Fronds relatively small, reaching about 25 cm. in width, usually widest at the middle, the basal pinnae equalling or smaller than those above, acutish, usually not drooping at the ends *M. strigosa*

Fronds larger, reaching 50 cm. in width, usually widest at the base, the basal pinnae equalling or longer than those above, acuminate, usually drooping at the ends.

M. substrigosa

MICROLEPIA PLATYPHYLLA (D. Don) J. Smith, London Journ. Bot. 1: 427. 1842.
Davallia platyphylla D. Don, Prodr. Flor. Nepal. 10. 1825.

Perhaps the most widespread species in cultivation. (It is the only one listed in Hortus II.) In Mrs. Fay MacFadden's lathhouse in Los Angeles, this sometimes grows to nine feet in height. Mrs. MacFadden notes that its yellow-green fronds provide a nice color note in contrast to the normally darker green leaves of other ferns. She says that it needs shade and protection from the wind.

MICROLEPIA SPELUNCAE (L.) Moore, Ind. Fil. XCIII. 1857.

Polypodium speluncae L. Sp. Pl. 1093. 1753.

In its broadest sense, *M. speluncae* is one of the most widespread species of ferns, being essentially pantropical. It occurs abundantly in India, China, the Philippine Islands, the East Indian islands, Polynesia, Africa, and South America. Even so, it is a little doubtful if it is in cultivation in the United States at the present time. All the specimens that I have seen so determined are in reality *M. strigosa*. The characters given in the key should serve to distinguish these two.

MICROLEPIA FIRMA Mettenius ex Kuhn, Linnaea 36: 146. 1869.

There is a plant growing in the grounds of the University High School, Los Angeles, California, that I identify as this species, although with a little doubt. The specimen that I saw was collected by Mr. A. W. Roberts on April 16, 1952, and is, I believe, deposited in the herbarium of the University of California at Los Angeles. I reported the name at first as *Microlepia pilosula* (Wallich) Presl, following the current application of that name. However, recently Dr. W. A. Sledge, of the Botany Department, University of Leeds, England, has published a paper¹ in which he shows that the name *pilosula* has been misapplied and that the species usually so named is really *M. firma*, a species of India that has up

¹ Sledge, W. A. *Microlepia speluncae*, *M. trapeziformis*, and *M. firma*. Kew Bulletin Miscellaneous Information 1956: 523-531.

till now been little known or essentially unknown. The real type of *pilosula* is only a very pubescent variant of *M. speluncae*, that described as *M. speluncae* var. *villosissima* C. Christensen, which should now be called var. *pubescens* (Hooker) Sledge, an earlier varietal name than *villosissima*. Additional cultivated material of *M. firma* is desirable to verify the determination.

MICROLEPIA STRIGOSA (Thunberg) Presl, Epimel. Bot. 95. 1849.

In southern California *Microlepia strigosa* is becoming common; I have seen specimens in the garden of Mrs. MacFadden, in Griffith's Park, in the garden of Dr. W. C. Drummond, in A. W. Roberts' greenhouses, from the Huntington Botanical Garden, and elsewhere. It has mostly passed erroneously as *M. speluncae*. As noted above, the true *M. speluncae* is a different species, that may not be in cultivation in the United States at all. It is a much larger plant than *strigosa* (being mostly quadripinnate), with a thinner, more herbaceous texture. The veins, at least in dried specimens, are inconspicuous and not raised, and the hairs of the rhachises are more slender and spreading.

MICROLEPIA STRIGOSA forma **MacFaddeniae** Morton, f. nov.

A f. typica pinnis plerisque reductis, subrotundis, segmentis paucis, imbricatis sterilibus differt.

Type in the U. S. National Herbarium, no 2,202,671, collected in the garden of Mrs. Fay MacFadden, 5450 Carlin Street, Los Angeles, California (*MacFadden* 26828).

This peculiar form hardly looks like a *Microlepia* at all—I have seen specimens identified as *Nephrolepis Duffii* and *Lindsaea cultrata*, both plants absolutely and completely different. The relationship to *Microlepia*, and to *M. strigosa* in particular, is shown by the pubescence of septate hairs on the rhachises and lower surfaces



MICROLEPIA STRIGOSA F. *MACFADDENIAE*

of the leaves. Such hairs are unknown in *Nephrolepis* or in *Lindsaea*. *Nephrolepis Duffii* has the ordinary broad chaffy scales on the rhizome just as do all other kinds of *Nephrolepis*. The somewhat hairlike rhizome scales of *Lindsaea cultrata* are different from the soft hairs of *Microlepia*. In all its characters *Lindsaea cultrata* is a typical *Lindsaea*, with trapeziform pinnae, angled rhachis, and so on.

This new plant, which I am naming in honor of Mrs. Fay MacFadden in recognition of her services in introducing new ferns to cultivation, has pinnae of a peculiar shape. They are condensed, so to speak, the several pairs of fan-shaped segments being curved and imbricated so that the whole pinna is not plane but somewhat cup-shaped. However, sometimes, as on the type specimen, the lower pair or lower two pairs of pinnae are elongate and more or less plane, in which case the segments are much more numerous, fan-shaped or once-lobed.²

It seems possible to me that this plant is a hybrid between *M. strigosa* and some other species, possibly not even a *Microlepia* at all. All the known plants of *MacFaddeniae* are completely sterile, not even producing sterile sporangia. However, it can pass as a form of *M. strigosa* in order to give it a name. The origin is unknown. Mrs. MacFadden believes that her plant came from Morgan's Nursery, Pasadena; Mr. Morgan stated that he had brought it from Ceylon under the name *Lindsaea cultrata*. I have seen other collections from the gardens of Mrs. Dorothy Behrends, Mr. A. W. Roberts, and Mrs. J. Chenny, all of Los Angeles.

MICROLEPIA SUBSTRIGOSA Tagawa, Acta Phytotax. Bot. 5:

189. 1936.

The large plant that is passing as *M. strigosa* in South-

² In general form, the pinnae suggest those of a fern prized in British gardens as *Athyrium Filix-femina* f. *Frizelliae*, as illustrated in Druery's British Ferns and Their Varieties fig. 79.

ern California is apparently to be identified as *M. substrigosa*, a plant that has never been reported in cultivation.³ It was described from wild plants collected in Formosa and Japan (Kyushu). The characters given in the key above are those observed in living plants by Mrs. Barbara Joe Hoshizaki, and communicated to me in a letter dated June 24, 1957. Her observations were made in the garden of Mrs. MacFadden.

This species is represented in the U. S. National Herbarium by Mrs. MacFadden's no. 26732. It remains to be determined if it is truly different from *M. strigosa*, or if it might not more properly be classed as a variety or subspecies.

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The Genus *Ceterach* in Madagascar

MME. TARDIEU-BLOT

The genus *Ceterach* has not up until now been reported from Madagascar, so far as I am aware. The genus is composed of a very small number of more or less well-differentiated species. *Ceterach officinarum* DC., which has the broadest geographic range, is known in Europe, Asia, and North Africa. Up to the present, *C. cordatum* (Thunb.) Desv. has been considered South African, although it is known also from St. Helena. Sim¹ described two varieties, var. *namaquense* (Pappe & Rawson) Sim and var. *pinnatifidum* Sim. *Ceterach aureum* is a species of the Atlantic Islands. Kümmerle² described a fourth species, *C. Phillipsianum*, from Socotra and Abyssinia. These species, sometimes rather similar in aspect, are distinguished principally by the scales and the spores.

In the herbarium of the Muséum d'Histoire Naturelle

³ As mentioned above, the true *M. strigosa* has been erroneously going under the name *M. speluncae*.

¹ Ferns of South Afr. 176. 1915.

² Botan. Közl. 6: 287. 1909 [1910].

I have found a *Ceterach* collected in Marovato, on Mont Morahahiva, in the vicinity of Isomono, on the right side of the Valley of Manambolo, Madagascar, at an elevation of 1,100 meters by H. Humbert (no. 13,273). It was growing on gneissic rocks in a sclerophyllous forest with a western exposure. The plant is altogether identical with *C. cordatum* var. *capense* (Sprengel) Hieron. ex Kümmerle³ which is characterized by having the fronds slightly dimorphic, the fertile the larger (ca. 13 cm.) and pinnate, the sterile smaller (4–5 cm. long) and pinnatifid, subsessile, the segments obtuse, the scales ferrugineous, lanceolate, more or less cordate at the base, the margins bearing some prolongations, the tips more or less dentate, the cell walls being reddish and slightly thickened, and the lumen not colored. The spores are anisopolar, bilateral, monolete, oblong, and rugulose.

MUSÉUM D'HISTOIRE NATURELLE, PARIS, FRANCE.

Shorter Notes

FROZEN FIDDLEHEADS AGAIN:—A report of the complete blasting of all the leaves in a colony of ostrich fern was made in the first issue of the Journal this year. All the unrolling croziers were noted as killed, and the blame was put on one of two unusually low temperatures in May, 1956. Something of the same sort appears to have happened again this year but with less complete killing of the leaves—the leaves seem to have been some that further developed and now show only partial areas browned in a way that suggests that the unrolling leaf and pinna tips were the sensitive parts.

Goldie's fern, which was also reported injured in the spring of 1956, came through unscathed this year, but numerous sensitive ferns nearby appeared to have justified their name by dying back completely. Presumably the leaves of this species suffered similarly during 1956

³ *Op. cit.* 288. 1910, based on *Gymnogramma capensis* Sprengel ex Kaulf. *Linnaea* 6: 183. 1831.

but were overlooked in the more conspicuous injury to the ostrich ferns.

One other casualty, presumably of winter origin, may be reported. A few years ago, a plant of the narrow-leaved chain-fern was transplanted from Dr. Allison's neighborhood of Hewlett, Long Island. The situation for its growth proved entirely favorable for several years. Last summer, it sent up several tall, fruiting leaves. But this year no signs of growth are detectable. Presumably the absence of a protective snow-cover may be blamed.—R. C. BENEDICT, *Pilot Knob, N. Y.*

MAIDENHAIR AS A SOURCE OF MEDICINE:—In 1712, an English translation of a French work on drugs was published.¹ A hurried scanning of the pages and pictures, which were crudely done and included some caricatures of various animal sources, disclosed two pages on "Maidenhair," referring to the "syrup capillaire" that is still cited as used in Europe. Two ferns were pictured as "maidenhair," one the "Common Maidenhair," which could well be *Asplenium Trichomanes*, and the other the "Golden Maidenhair," which is surely *Asplenium Adiantum-nigrum*. The text refers to several other "varieties" of syrup of Maidenhair which were prepared from other ferns, among them the Venus' Hair [*Adiantum Capillus-veneris*], *Scolopendrium*, and *Ceterach*. The highest qualities were ascribed to syrups prepared from the Maidenhair of Canada [*Adiantum pedatum*] and the Maidenhair of Montpellier [from the illustration, a species of *Asplenium*]. Among other ferns mentioned were Polypody, and "Salvia vitae" [*Asplenium Ruta-muraria*], but surprisingly the male fern is not noted anywhere in the text. The above information is translated

¹ Pomet, Pierre. A Complete history of drugs, written in French, to which is added what is further observable on the same subjects from . . . Lemery and Tournefort. London, 1712. This is a translation, with additions, of Pierre Pomet, *Histoire générale des drogues*. Paris, 1694.

from Pomet.

One of the interesting bits of text² has to do with the then current knowledge of fern reproduction [translated from Lemery]: "This Plant bears no Flowers; its Fruit, according to M. Tournefort's Observations, is produced in a Folding of the End of one of the Leaves, which, after it is stretched out, it encloses several spherical Coverings which are caked to the said Folding, and can not be discovered but by the Assistance of a Microscope. These Capsules, or Coverings, are furnish'd with, as it were, a Purse-String, which by its Contraction opens it; they contain some little Seeds in 'em that are almost round."

—R. C. BENEDICT, 2214 Beverly Road, Brooklyn, New York.

Recent Fern Literature

FERNS OF THE OTTAWA DISTRICT¹—This manual is unique in that it does not cover a State, Province, or phytogeographic region, but an area with a thirty-mile radius, centered at Ottawa and covering parts of the provinces of Ottawa and Quebec. This limited area has a rich fern flora of 36 species, one hybrid, and several varieties and forms. The fern allies are not included. The frontispiece is a detailed map of the district showing the locations of the ten counties covered, the streams, lakes, and towns. There is a concise description of each species (perhaps too brief), mention of the habitats, and of the seasons in which the species will be found in fertile condition. The illustrations are photographs of herbarium specimens; each particular specimen was carefully prepared and is better than the average run of herbarium specimens. The illustrations show the gross morphological features by which each species can be

² *Op. cit.* 1: 87.

¹ Cody, W. J., *Ferns of the Ottawa District*. Canada Department of Agriculture Publication 974, pp 1-94. 42 illustrations and distribution maps. 1956. Price \$1.00.

recognized. There is no attempt to show the details of the sori or indusia. The book is complete with keys to the families, genera, species, a glossary, and index. The text, typed on a varityper with the result that certain letter combinations are spaced unevenly, is printed by photo-offset and bound in an attractive green buckram, lettered in gold. The nomenclature is essentially that used in the 8th edition of Gray's Manual of Botany, except that the generic name *Matteuccia* is used in place of *Pteretis* for the Ostrich-fern. All of the entities described are backed by voucher specimens in herbaria of The Botany and Plant Pathology Division, Canada Department of Agriculture, The National Museum of Canada, and The Botanical Institute of the University of Montreal. A few species that have been reported from this area are excluded in the absence of confirming specimens. One of these is *Botrychium lunaria*. Members of the American Fern Society who were on the foray around the Gaspé Peninsula last summer will recall shivering in the fog-shrouded summit of Mount Ste. Anne, above Percé, in search of this elusive species. This exclusion is a challenge to collectors to look for it, and someone who is in the proper place at the proper time will find it in the Ottawa District for it is known to occur in adjacent areas in Quebec and northern Michigan. The absence of the spinulose fern, *Dryopteris spinulosa*, raises the question of what local ecological conditions are responsible for its absence here while it is so abundant in the surrounding areas.

Aside from the technical aspects, the book is a record of a keen interest in ferns, of many hours spent tramping through the fields and woods in search for them, not only by the author but also by the other members of the Ottawa Field Naturalists Club. As I leaf through this book, I find familiar ferns—old friends—that bring a flood of memories of places where I collected a particular

species, the circumstances, and the people who were my companions at the time. Many of these ferns are widespread in Canada and the United States. I feel certain that this book will be very helpful to our Canadian friends with botanical interests.—CLAIR A. BROWN, *Louisiana State University, Baton Rouge 3, Louisiana.*

“A NATURAL HYBRID, $\times$ ADIANTUM TRACYI C. C. HALL,” by W. H. Wagner, Jr.,¹ describes a naturally occurring hybrid between *Adiantum Jordani* and *A. pedatum* that has been found in California several times. It was first found in 1895 by J. P. Tracy as a single plant growing among redwoods along the Eel River, near the town of Pepperwood, Humboldt County; this was transplanted and propagated by Mr. Tracy, and descendants are now growing in the Strybing Arboretum in San Francisco, and elsewhere. A plant found near Guerneville, on the Russian River, Sonoma County, was cultivated by Mr. Carl Purdy, and introduced by him into cultivation in England, where it was misidentified as the Asiatic species *A. flabellulatum*. It has persisted in cultivation in England and has proved to be moderately hardy. Other wild plants have been found near Bear Valley, Marin County, and Garberville, Humboldt County. Since this plant is a potentially valuable addition to the cultivated ferns, at least in warm regions like California, it is worth while to give its distinguishing characteristics, quoting from Dr. Wagner:

Adiantum $\times$ *Tracyi* “may be distinguished from *A. pedatum* by the overall shape of its frond: in mature blades of *A. pedatum* there are normally 5–9 major divisions of the blade and the blade is broadly fan-shaped; in *A. $\times$ Tracyi* there are usually only three major divisions, the two lateral pinnae and the somewhat longer central pinna, and the blade is more nearly triangular. Also the sori of the hybrid average two to three times as long

¹ Madroño 13: 195–205. figs. 1–3. 1956.

as those of *A. pedatum*. From *A. Jordani*i the hybrid is most readily separated by the form of the blade also: in *A. Jordani*i the leaf is broadly lanceolate and pinnate in construction and the pinnae are gradually reduced in size from base to apex; in *A. × Tracyi* the blade is relatively much broader at the base and it usually shows a rather sudden reduction in pinna length from the basal pinnae to those above. The pinnae of *A. Jordani*i are almost perfectly flabellate while those of the intermediate have a strongly developed lower margin about twice as long as the inner margin."

Unlike its parents, the hybrid appears to be evergreen, a decided advantage for a garden plant, and also quite resistant to injury.—C. V. MORTON.

A MANUAL OF THE SPORES OF NEW ZEALAND PTERIDOPHYTA—Although this technical publication¹ may be of interest primarily to palynologists, it presents information the professional fern taxonomist cannot ignore. The book is divided into three main parts—spore morphology, spore descriptions, and palynological aspects. The morphology of the fern spore is explained in detail and follows in general the terminology of Professor G. Erdtman. However, Professor Harris has given different meanings to some of the terms in preference to creating new terminology. He uses "laevigate" in place of "psilate" for smooth spores; "scabrate" means flecked with minute pits or elongations—the "psilate" in part of Erdtman and "scabrous" as used by Fageri and Iversen.

The Pteridophyta of New Zealand are divided into 8 orders, 19 families, 51 genera, and 170 species. The systematic arrangement is similar to that of Holttum; the nomenclature is mainly that used by Crookes. However, Harris recognizes only the genera *Hymenophyllum* and *Trichomanes* in the family *Hymenophyllaceae*.

¹ Harris, W. F. A Manual of the Spores of New Zealand Pteridophyta. New Zealand Department of Scientific and Industrial Research, Bulletin 116, pp. 1-186. 1955. Price 23 sh. (\$3.22).

Detailed descriptions and drawings of the spores of each species, along with the habitat and distribution, are given. One important feature is a cross reference to the appendix, where the voucher specimens from which the spores were obtained are cited and a statement of the method by which the spores were prepared for study.

Under the heading "Comparisons," Harris not only discusses similar spores and methods of distinguishing them but also gives other pertinent data, such as their occurrence as sub-fossils or fossils in peat and lignites. He has a detailed key to the genera, with the inclusion of occasional family or sub-family categories. This key is not entirely dichotomous and, in many places, two to four genera are included under one arm. He includes also a key to the genera under each family, and additional keys to the species under each genus that has two or more species. The excellent detailed drawings of the spores of 170 species are arranged on ten plates. There are three photographic illustrations of fern spores.

Bilateral spores tend to lose their perispore under certain conditions of preservation and also many reagents used in the preparation of spores for study or the isolation of spores from peats and lignites destroy the perispore. The resulting smooth, monolete structures have been considered unidentifiable. Professor Harris has presented a classification of these which, although not perfect, is an excellent attempt. It must be emphasized that careful measurements in quantity are needed to identify these structures.

The fern taxonomist will be interested in the fact that spore morphology supports the removal of *Loxsoma* from the *Hymenophyllaceae*. The reviewer anticipates that other adjustments in classification or the recognition of genera will be correlated with spore morphology in the future. A fern description in the future will not be considered complete until the spores have been ade-

quately described. Fifty-four per cent of the New Zealand pteridophytes have a trilete aperture and 46 per cent a monolete aperture.

The third part—Palynological Aspects—deals with the various phases of the geographical and ecological distribution of ferns. Thirty-six per cent of the fern flora is endemic to New Zealand. Although fair percentages extend to the islands northward and southward, there is a marked affinity to the Australian flora in that 76 species or 45 per cent are common to both regions. It is significant that nine of the species also occur in South America.

One of the major objects of the present study is to determine the possible value of fern spores as index fossils; thus considerable attention was given to conditions favoring aerial transportation and establishment. Strong evidence is presented that fern spores can blow at least 500 miles. It is this reviewer's experience that certain fern spores *are* good index fossils.

This publication adds materially to our information about pteridophyte spores. A palynologist should be able to identify them to the genus, perhaps to the species, easier than he can much of the wind-blown pollen. Also, once the spores have been identified, it may be possible to give an interpretation of paleoclimates and paleoecological conditions. Professor Harris is to be congratulated for his excellent study of this difficult phase of fern research.—CLAIR A. BROWN, *Louisiana State University, Baton Rouge, La.*

FERNS OF OHIO, by Harry H. Vannorsdall,¹ is another in the growing list of state fern floras. Mr. Vannorsdall is obviously an Ohio lover, a nature lover, and a fern lover, and he manages to communicate a good deal of his enthusiasm to the reader. The book is written

¹ Ferns of Ohio, by Harry H. Vannorsdall, pp. 1-298, *figs. 1-215*. November, 1956. Published by the author. Obtainable from the Curtis Book Store, Wilmington, Ohio, \$3.00 (postage included) plus 9¢ Ohio Sales Tax.

not only with the intention of stimulating the interest of amateurs but also of serving as a textbook for instruction in secondary schools. (A series of questions to be answered by the student is appended to many of the discussions. Surely these questions are rather superfluous in a work of this kind; they give an air of naïveté to the whole.) All the species of ferns treated (the fern allies are not included), and some of the varieties and forms, are illustrated by photographs, often by several pictures showing habitats, whole fronds, and enlarged details. These photographs are considered by the author as sufficiently diagnostic to allow plants to be identified by them without a formal key, which may or may not be true. As usual, correct identifications will depend not on a key or on photographs but on the accuracy of observation of the student. The book is produced by lithoprinting and is quite similar in format and style to Reed's *Ferns and Fern-allies of Maryland and Delaware*. Some of the photographs are not altogether satisfactory (for instance, figure 15 showing a prothallium), but many are outstanding, as figure 17 (southern maidenhair-fern), 26 (wall-rue spleenwort), 41 (ebony spleenwort), 66 (narrow-leaved spleenwort), 133 (marginal wood-fern), and 209 (showing the venation of *Woodwardia areolata*). Particularly noteworthy are the excellent pictures of the excessively rare *Asplenium kentuckiense*, a plant that has been illustrated only once before, as far as I know. Naturally, it is vitally important in a work of this kind that the plants illustrated be correctly identified and typical of the species represented, and this seems to be the case generally. Figures 111 and 112, which are intended to show the crested wood-fern, seem to me to be really Clinton's wood-fern (Mr. Vannorsdall will not be the first to have confused the two), and I have vague doubts concerning one or two others (it seems possible that figures 102 and 103 repre-

sent *Cystopteris fragilis* var. *protrusa* rather than var. *Mackayi* as they are labelled.)²

The treatment in the text is accurate in general, and skillfully steers a course between the strictly popular and the technical. The nomenclature follows Fernald (in Gray's Manual, 8th edition). The genera are in alphabetical order, an unusual arrangement but perhaps not without merit in a work of this sort. The magnification of the photographs is indicated in the accompanying legends, but it would have been helpful to have actually included a ruler in the picture, which would more readily

² Spelled *Mackayii* by Mr. Vannorsdall, following Fernald and others. However, a terminal "y" is considered a vowel in the making of Latin species names and is therefore followed by a single "i." It is entirely justifiable to consider the original spelling "Mackayii" an orthographic error and to correct it to "Mackayi." A similar point is concerned in such a name as *Asplenium Trudelli*. The standard Latinization of Mr. Trudell's name would be Trudellius, the genitive of which is Trudellii. As a matter of fact, the International Code of Botanical Nomenclature gives a clear statement of the procedure to be followed: "When a new specific or infraspecific epithet is taken from the names of a man, it should be formed in the following manner:

(a) When the name of the person ends in a vowel, the letter *i* is added (thus *glazioui* from Glaziou, *bureaui* from Bureau), except when the name ends in *a*, when *e* is added (thus *balansae* from Balansa).

(b) When the name ends in a consonant, the letters *ii* are added (*ramondii* from Ramond), except when the name ends in *-er*, when *i* is added (thus *kernerii* from Kerner).

Thus "*Trudelli*" with a single "i" should be considered an orthographic error. According to the new Code (Article 73), "The original spelling of a name or epithet must be retained, except that typographic or orthographic errors should be corrected." (Italics mine). We are thus not only justified in correcting the name of *Trudellii* but are really supposed to do so, if we are going to follow the recommendations of the Code. I have gone into this matter in some detail not as a criticism of Mr. Vannorsdall for his use of *Trudelli* (for which he has ample precedent) but to point up a rather common misunderstanding. There is an evident value in following the Code consistently in this respect, as an editor like myself is the first to appreciate, but one can determine the correct ending automatically. But such names in *i* or *ii* are legion and past usage has been highly inconsistent, and if one is to allow the original usage to be a guide it involves endless checking, many times in publications that are not readily available, and the advantage gained, if any, is incommensurable with the expenditure of time involved.

show the scale of enlargement or reduction, as the case may be.

A few specific comments may be in order. The discussion of *Ophioglossum vulgatum* shows some confusion. The author seems to indicate that typical *vulgatum* and its variety *pycnostichum* occur in Ohio. Actually, if one is going to segregate *vulgatum* into varieties, following Fernald, then typical *vulgatum* does not grow in the United States at all; the two kinds growing in Ohio are var. *pycnostichum* and var. *pseudopodium*. The author seems to have misunderstood the common name "bulblet-fern," for this is consistently misspelled "bulbet fern" throughout. Exception can be taken also to the recommendation for mounting herbarium specimens with scotch tape; this material has not proved an acceptable substitute for the gummed linen used for mounting in most large herbaria. Of especial interest is the account and illustration of the peculiar gametophytes that have been found in Pike County and which have been identified as belonging to the genus *Hymenophyllum*. This is apparently an instance of the perpetual persistence of a juvenile stage; these gametophytes never develop sporophytes, as far as is known. If I recall correctly, Dr. W. H. Wagner has attempted to stimulate them artificially in the greenhouse to develop sex organs and sporophytes, but without success thus far. The genus *Hymenophyllum* has been known in the United States only from South Carolina, where it is represented by a species that is still not adequately known, but which has been identified as *H. tunbridgense*. Is it not likely that the Ohio gametophyte will prove to be of the same species? If so, it will indicate a more widespread distribution in the United States than we know at present.¹

¹ Dr. Wherry writes me that he considers that the illustration labeled "Clinton's Wood Fern" really represents *Dryopteris Slossonae* (*D. cristata* × *marginalis*), and that the forms of the Northern Lady Fern are misunderstood.

The book contains sections on ferns as a hobby, the life cycle of ferns, collecting, transplanting, and photographing ferns, and a discussion of nature study in schools and colleges, as well as a section devoted to picturesque collecting localities, which will be of special interest to residents of Ohio, for the author gives a list of the interesting ferns to be found in each place. Taken all in all, *Ferns of Ohio* is a fine job. It is recommended.—C. V. MORTON.

“DISTRIBUTIONAL, ECOLOGICAL AND PHYTOGEOGRAPHICAL OBSERVATIONS ON THE FERNS OF SOUTH WEST AFRICA,” by Dr. E. A. C. L. E. Schelpe¹ gives an account of the fern flora of South West Africa (located on the western side of Africa between Angola and the Union of South Africa), a region of desert thorn-scrub and arid rocky mountains that has been regarded as being devoid of ferns. However, recent collections, including those of Dr. Schelpe during an expedition in 1954, have revealed a limited number of ferns, twenty species actually, many of them of restricted occurrence. Most are found in rock crevices or around boulder bases (*Actiniopteris australis*, *Adiantum caudatum*, *Ceterach cordatum*, *Cheilanthes Dinteri*, *C. hirta*, *C. multifida*, *C. parviloba*, *Doryopteris concolor* var. *Kirkii*, *Notholaena Eckloniana*, *N. Marlothii*, *N. Rawsonii*, *Pellaea calomelanos*, *P. deltoidea*, *P. Goudotii*, *P. robusta*, and *P. viridis*). It will be noted that these genera, most of them familiar to collectors in the southwestern United States, all belong to the Pteridoideae, except for *Ceterach*. In only one locality do moisture-loving species occur, at the base of cliffs of the Great Waterberg, where three mesophytes are found—*Microlepia speluncae*, *Dryopteris* aff. *pseudoguentziana*, and *D. Thelypteris* var. *squamigera*. The latter is a South African representative of our common eastern marsh fern. In open parts of the country only *Ophio-*

¹ Journ. So. Afr. Bot. 22: 1-22. 1956.

glossum polyphyllum occurs. For the rest, only seasonal aquatic ferns occur—four species of *Marsilea* and one of *Azolla*. Dr. Schelpe concludes that all the rock ferns have drought-resistant rhizomes and also probably prothallia capable of withstanding prolonged dry periods.—C. V. MORTON.

Notes and News

REFLECTIONS ON SOME ITEMS IN VOL. 47, No. 1.—Editor Morton's treatment of the cultivated sorts of *Pteris* brought to mind two memorable Florida trips. In 1923, the late Dr. John K. Small offered to guide me to a "Florida tree-fern." Very early one morning we drove along a road newly cut through a seemingly otherwise undisturbed jungle near the then small settlement of Pompano. There we came on vast clumps of a magnificent massive fern, fully 6 feet tall, shining in the rays of the rising sun. Small called it *Litobrochia tripartita*, but to others it is a *Pteris*. What seemed remarkable was the presence of a tropical Old World fern in this remote wilderness; but there are winds in Florida that can blow spores great distances, and so it no doubt came from the Royal Palm Nurseries cultures.

Some years later, the St. John brothers took me to a damp woods near Brooksville, and there scattered among the limestone rocks were scores of plants of *Pteris cretica*; the surprising point was that every plant had its segments medially white-striped—which would make them the so-called cultivar *albolineata*. The manifest ability of this plant to come true from spores suggests that it is more than a mere freak.

On page 29, my friend Benedict indicates his dislike of the term frond; but on page 8, Tryon, and page 21 & 22, Wiggins seem not to share this attitude. At any rate, errors in statements of dimensions and mode of cutting are just as serious whether made under the terms frond, leaf, blade, lamina, etc.



PTERIS TRIPARTITA, POMPAÑO, FLORIDA, 1923

As a conservationist interested in saving vanishing species in wild garden sanctuaries, I always regret to find (as on page 44) Bartholomew's Cobble referred to as having only "outcroppings of limestone," without reference to the presence there of far more silica rock and the correspondingly acid soils. While it is, of course, true that the rare ferns for which this locality is famous do grow chiefly on limestone, this is certainly not the case with all of them. *Asplenium platyneuron* grows larger in non-limy habitats, and is to be classed as lime-tolerant; fern gardeners often poison it by dosing it with excess lime. And the northern *Ophioglossum* (like the *Selaginella* about which I wrote in a previous issue of this Journal) is a lime-shunning, acid-soil plant. If wild-flower gardeners proceed to assume that all the 500 species native to the Cobble need lime, they are going to perpetrate a lot of wild-flower destruction.

Mr. Carl Starker, whose advertisement appears on the inner back-cover, usually sends out superior, accurately named plants. In his recent catalog supplement I was puzzled by the listing of a *Polypodium sempervivoides*. On inquiring about this, I was advised that it was a slip for *P. polypodioides*, which seems worth calling to the attention of our members.—EDGAR T. WHERRY, University of Pennsylvania, Philadelphia, Pa.

DRYOPTERIS AS AN ANTHELMINTIC.

May 12, 1957

Dear Mr. Morton:

I was surprised about your statement that the usage of *Dryopteris Filix-mas* as an anthelmintic is "maintained perhaps up to the present time."¹ In some parts of Europe it is still extensively used for this purpose and there can be no doubt that the name "Wurmfarne" is derived from that use. Recently, a Dutch pharmacist who lives in Zürich asked me about the identity of several

¹ This JOURNAL 47: 26. 1957 (footnote).

rhizomes he had obtained as *D. Filix-mas* from Swiss pharmacies. He told me he was investigating a poisonous compound, by the name of *aspidine*, if I remember correctly, present in the rhizomes of *D. austriaca*, which makes them unfit for use as an anthelmintic. He was much distressed when almost all his rhizomes turned out to belong to *D. austriaca*. (*Dryopteris Filix-mas* is also very poisonous and its use is therefore gradually being abandoned.)

With regard to the source of the name *Dryopteris Robertiana*, in addition to the leaves being similar in shape I believe its scent is also supposed to resemble that of *Geranium Robertianum*.

Very sincerely yours,

Karl Kramer

Botanisch Museum

Utrecht, The Netherlands

INDEX OF UNUSUAL FERNS?

April 30, 1957

Dear Mr. Morton:

Has it ever been the custom in the American Fern Society to keep a reference list or index of the locations of unusual ferns? The question came to mind following the death of Harold Rugg, who knew so much about ferns, especially in Vermont and New Hampshire. When a member dies or for some reason loses interest, there is often no record of his knowledge of fern stations. On various occasions Professor Rugg has given me detailed instruction as to how to find certain ferns. One has to have these locations pin-pointed. Such general directions as "on cliffs on the western shore of Lake Sunapee" are not a very helpful guide.

Naturally an index such as mentioned would have to be confidential or else the station might soon disappear. The information however could be used by the Society

in various ways and be available in planning field trips. Botanical gardens interested in ferns might be a good place to preserve some of the rarer species and the Society could be helpful if they knew where the ferns grew.

When a contributor to the journal reports the discovery of a new station, he could include for the fern index detailed directions as to its location. Such directions would not be for publication.

Perhaps such an index exists. Does it?¹

Sincerely,

Benjamin R. Allison

CONSERVATION IN FLORIDA?

October, 1956

Dear Mr. Morton:

I was much dismayed to note that Pineola, Florida, was being overrun by cattle, and that the famous "Buz-zard's Roost" property was up for sale. Can you get anyone interested in reporting on these fine fern localities and their probable future? If they are in danger enough maybe we can get someone interested in preserving them.

Sincerely,

Irving Knobloch

Michigan State University

East Lansing, Michigan

American Fern Society

REPORT OF THE NEW JERSEY MEETING.—An informal meeting of Fern Society members living in New Jersey and in the metropolitan New York area was held in the garden of Mr. Thorlief Fliflet, Mountain Lakes, New Jersey, on June 22, 1957. It was attended by some thirty members and guests. In the regular garden, large native ferns have been used as accents in formal designs wherever afternoon shade is available, and they have also been

¹ No. [Ed.]

used silhouetted against dark backgrounds. English and other horticultural varieties have been planted here in the shade of small trees and shrubs. The fern garden proper, behind a wall of the regular garden, forms a part of a woodland that includes a picnic ground with a fireplace. Here native ferns are arranged along paths, with the large-growing species set in groups well apart at different levels.

In the house a display of books on ferns was on view, including Thomas Moore's "The Ferns of Great Britain and Ireland," nature printed, 1857. Spore cultures in a Wardian case of plastic cloth placed in a window were also exhibited. Our Vice-President, Dr. Allison, was present and addressed some appreciative remarks to the audience. Later in the day, the group visited the lake-front garden of Mr. and Mrs. Wayne Grunden, where a variety of ferns and wild flowers have been set out against a background of great natural beauty.

The species now in cultivation in the Fliflet garden are the following:

NATIVE AMERICAN SPECIES

Adiantum pedatum
Asplenium platyneuron
trichomanes
Athyrium filix-femina
pycnocarpon
thelypteroides
Blechnum spicant
Botrychium virginianum
Camptosorus rhizophyllus
Cystopteris bulbifera
fragilis
Cryptogramma crispa
Dennstaedtia punctilobula
Dryopteris campyloptera
clintoniana
felix-mas
goldiana
intermedia

Dryopteris marginalis
spinulosa
Lygodium palmatum
Matteuccia struthiopteris
Onoclea sensibilis
Osmunda cinnamomea
claytoniana
regalis
Pellaea atropurpurea
Phegopteris connectilis
dryopteris
hexagonoptera
Phyllitis scolopendrium
Polypodium virginianum
and f. cambricoides
Polystichum acrostichoides
and crested form
andersonii

Polystichum braunii	Thelypteris palustris
munitum	and crested form
Pteridium latiusculum	simulata
Thelypteris noveboracensis	Woodsia ilvensis
	obtusa

EXOTIC SPECIES AND HORTICULTURAL VARIANTS

Athyrium filix-femina var. corymbiferum

ibid. var. coronatum

ibid. var. grandiceps

ibid. var. victoriae

goeringianum

ibid. var. pictum

Dryopteris erythrosora

pseudo-mas f. cristata

filix-mas var. crispa f. cristata

filix-mas var. polydactyla f. daddsii

filix-mas var. dilatata f. cristata

T. FLIFLET, *Mountain Lakes, N. J.*

GROWTH OF THE AMERICAN FERN SOCIETY:—The Society has continued to grow at an amazing rate, considering that there has not been any special promotional campaign for new members. It took 25 years—from 1921 to 1946—to get from 300 to 400 members, seven years more—to 1953—to get from 400 to 500 members, and now only three and a half years to get from 500 to 615, the total as of July, 1957. We hope that the new members recently enrolled will remain in the Society, for the largest loss is from new members dropping out after a year or two. It may well be that some numbers of the Journal are less interesting than others, but this is inevitable, a matter beyond the control of the editors. However, during a year there is certain to be something of interest to all.—C. V. M.

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American Fern Journal

A QUARTERLY DEVOTED TO FERNS

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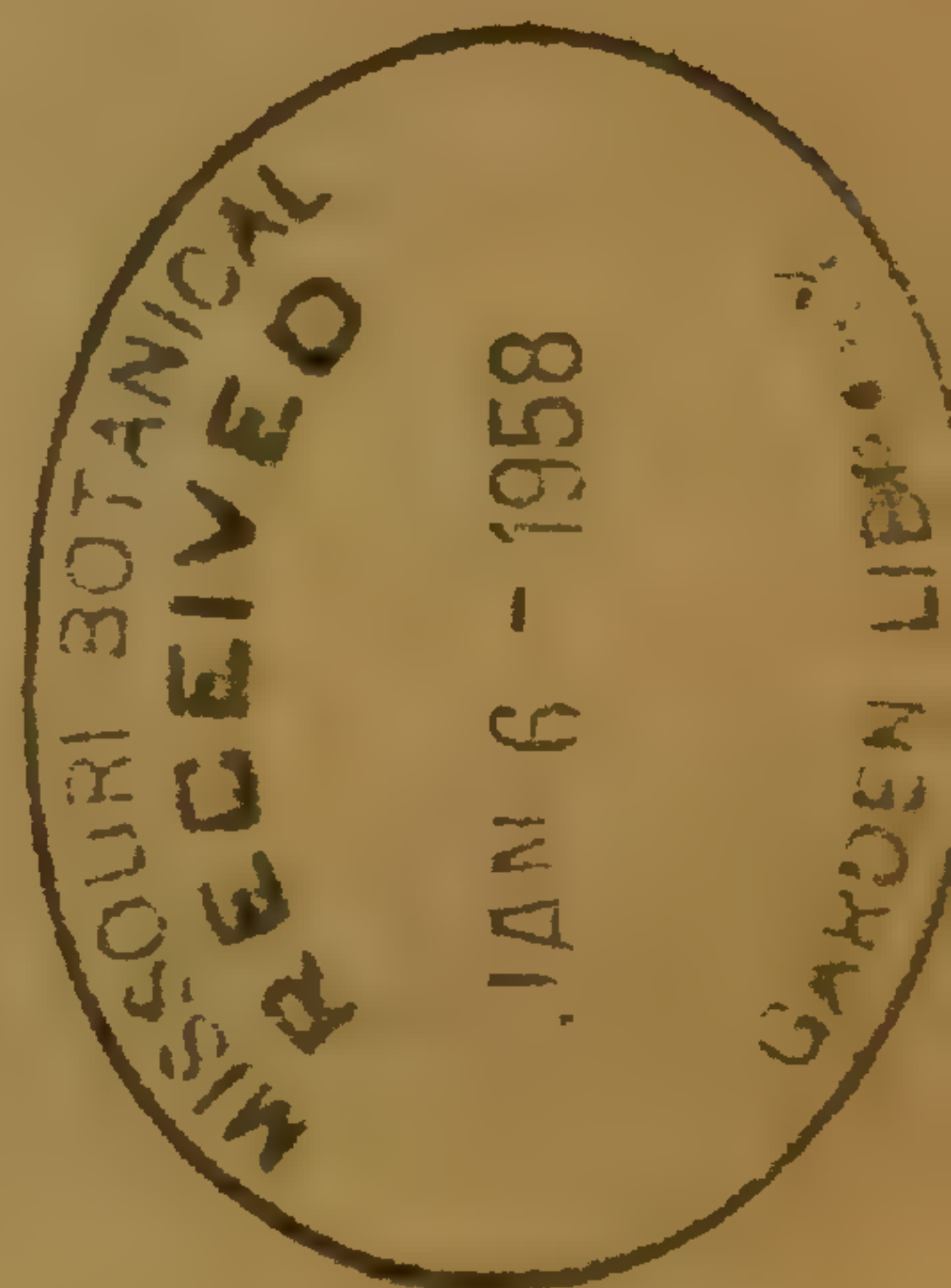
EDITORS

C. V. MORTON

R. C. BENEDICT

IRA L. WIGGINS

A. C. SMITH



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American Fern Journal

VOL. 47

OCTOBER–DECEMBER, 1957

No. 4

The Problem of *Polypodium virginianum*¹

IRENE MANTON

Polypodium virginianum L. can scarcely fail to be familiar to members of the American Fern Society since, except in the southern United States where its range overlaps that of a very distinct species (the small subtropical epiphyte *P. polypodioides*), in the wide sense it is the only representative of the genus over a large area of the eastern seaboard of North America from the Carolinas to Nova Scotia and Canada. It is perhaps less commonly known that it is distinguished from all other temperate species of *Polypodium* by the presence of very peculiar glandular organs (paraphyses) among its sporangia. These can be detected with a hand-lens, though they require the low power of a microscope for details to be properly seen, since each paraphysis is about the size of a sporangium but with a number of glandular hairs on its head (*pl. XIV*). The function of these curious organs is not well understood, but they were discovered to be of very constant occurrence of Martens² and his collaborators who have not only used them for taxonomic purposes but have also plotted their geographical distribution. Besides eastern North America, where they are always to be found, populations of *Polypodium* with similar paraphyses occur again in China, providing a

¹ Prepared for delivery at the annual meeting of the American Fern Society at Stanford University, August 26, 1957, but unfortunately received too late to be read. [Ed.]

² Martens, P. Bull. Jard. Bot. Brux., 17(1). 1943; Martens, P., and Pirard, N., La Cellule 49: 385. 1943; Pirard, N., La Cellule 51: 155. 1947.

[Volume 47, No. 3, of the JOURNAL pp. 89–128, was issued October 16, 1957.]

nice example of a familiar type of disjunct geographical range (cf. C. DeVol in a recent number of this Journal).

Nevertheless, as one of the troublesome facts which cytologists discover, we are insufficiently informed as to what *P. virginianum* L. actually is. In 1953, we³ drew attention to the presence in Canada of two cytotypes, both of which possessed the characteristic paraphy-



PL. XIV. SPORANGIA AND PARAPHYSES FROM A WILD TRIPLOID BETWEEN TWO CYTOTYPES OF *POLYPODIUM VIRGINIANUM* × 75. PLANT FROM ROCKS BELOW GREAT FALLS, VIRGINIA

ses though in slightly different frequency. The chromosome numbers were $n = 37$ and $n = 74$ respectively but since we had no field observations and only one sample of

³ Manton, I., and Shivas, M. Two cytological forms of *Polypodium virginianum* in Eastern North America. *Nature* 172: 410. 1953.

each type to study, it was not possible at that time to pursue the matter further.

In the summer of 1955, however, I visited the United States to attend a scientific conference at Amherst, Mass., and I naturally used the occasion to collect *Polypodium* as opportunity offered. I collected and sent to England one sample from a wood near Amherst. Immediately after the conference, I attended the June field-meeting of the Torrey Botanical Club and posted another sample from a rock near the roadside at the foot of Smuggler's Notch in the Green Mountains in Vermont. Later in July I sent a third sample from a rock near a stream in the neighbourhood of Durham, North Carolina.

These plants survived the journey well, but the shock of being transplanted in midsummer prevented the production of sporangia till 1957 when they have all been normally fertile. They have now been examined cytologically and the results are surprising. The plant from Smuggler's Notch is diploid ($n = 37$); that from Amherst is tetraploid ($n = 74$), and the plant from North Carolina is a triploid hybrid.

The detection of a triploid hybrid as far south as Durham, North Carolina, is a fact of the greatest interest. It means for one thing that both parental cytotypes must be present in the State although one or both may be near the southern limit of its climatic tolerance. Then the mere existence of spontaneous hybridization tells us something about the affinities of the two cytotypes, and the details of chromosome pairing in the hybrid tell us more. This was very clearly seen in 1957 in many sporangia and it is of the familiar pattern of n pairs and n univalents (n in this case being 37). This indicates that though closely related and indeed in the particular relationship of parent and descendant (the diploid being the ancestral and older type) the tetraploid is nevertheless also related in equal degree to some other diploid species which

we have not yet indentified. In other words, the tetraploid is of that particular form of hybrid known as an allopolyploid or amphidiploid, and it cannot therefore be regarded as a local mutant or variety of the diploid. It is, genetically speaking, a separate species.

This conclusion is only a theoretical one at present, since no normal field or herbarium botanist can reasonably be expected to handle a species as such as long as it is only known by its chromosomes. My field notes suggest, however, that this limitation is perhaps only temporary. I believe that morphological and ecological differences will be found when more observations can be made. My very limited personal experience suggests for example that tetraploids are, sometimes at any rate, characterized by having shorter stipes, a more prostrate habit, and a tendency to ovate leaf-outline. We also found evidence of a greatly reduced frequency of paraphyses and larger cells. There might be other characters. The diploids seem, sometimes at any rate, to have a longer stipe, a narrower leaf-outline and a more erect habit. When grown side by side in pot-culture there is a definite seasonal difference, the diploids throwing up new fertile fronds about a fortnight earlier than the tetraploids but a fortnight later than the triploids, which display extreme hybrid vigour in this and other characters. It is possible also that the tetraploid is more at home in low-lying or southern districts while the diploid is almost montane; perhaps, differential resistance to summer heat is involved here.

These are, however, at present only suggestions based on far too little evidence. What is now required is concerted action to assemble records on a large enough scale to be significant. Only when this has been done will it be necessary to consider what they should both be called. In the Linnaean herbarium in London there is unfortunately no specimen of *P. virginianum*, so that we may perhaps never be able to ascertain directly what Linnaeus

himself saw, though we have his statement that it came from the state of Virginia.⁴ Two living plants have actually been received from Virginia in response to a request by my former colleague Miss M. Shivas. These have been fertile this year (1957), though they do not solve the problem. The first plant proved to be another triploid and the second a tetraploid. It is possible that the tetraploid is actually more numerous than the diploid in both the southern states in which triploids have been found, though both cytotypes must actually be present. The geographical evidence may therefore perhaps have to be used to decide where to allocate the Linnean name. This is an additional reason for needing to assemble fuller data.

This problem is therefore now very definitely at the stage in which co-operation from local field-botanists would be of the greatest value. What is needed is in the first place a collection of *Polypodium* samples from well-characterised ecological stations about which notes are taken. A herbarium specimen to show the original appearance of the plant in each case (complete with rhizome, leaf, and sporangia, if possible) should also be taken together with a live piece to be cultivated for a cytological check. If any would-be collector is unable to deal with the cytology, I will gladly be responsible for it if the living plant can be posted to me. This is very easy to do if a few inches of rhizome carrying a leaf or two are tightly wrapped (perhaps together with some moss to prevent crushing) in a small plastic bag of the type commonly sold for use in domestic refrigerators. It may then be put into a stout envelope and transmitted by letter or small-sample post, preferably by air. Large parcels should never be sent. It is also unwise to label the outside in a way likely to attract the attention of the British Customs authorities, who object to "live plants" but will generally tolerate without looking at anything that is called "scientific sample of no commercial value." In

⁴ Linnaeus, Sp. Pl. 1085. 1753.

every case, the exact place of origin should be clearly written in pencil with the plant, to avoid mistakes in labelling.

I would be very grateful to any members of the Fern Society who would care to contribute plants or information or both from any part of the total range of the two species and I look forward to being able to report progress in a later number of the Journal.

DEPARTMENT OF BOTANY, THE UNIVERSITY, LEEDS,
ENGLAND.

Gibberellic Acid and Ferns¹

IRVING W. KNOBLOCH

One of the greatest of all the growth-promoting substances discovered is gibberellic acid. It is prepared from *Fusarium moniliforme* and, when properly used, has a number of startling effects such as speeding up the growth of plants, the elimination of dwarfism and biennialism, and the changing of the photoperiod of some plants from long to short day.

Growing ferns from spores demands a great deal of patience and with this thought in mind, the writer decided to try the above acid on fern spores. Two flower pots of soil were sterilized. A quantity of fresh spores of the male fern (*Dryopteris filix-mas*) were sowed on the soil of the control pot. An equal quantity of spores from the same plant were soaked for two hours in an aqueous solution of gibberellic acid, 10 parts per million, and sowed upon the soil of another pot.

Unfortunately molds contaminated the control pot and this has made evaluation of the experiment difficult. However, the prothallia on the experimental pot were so much more numerous and more vigorous than those on the control pot that it seems safe to conclude that the acid *did* have an accelerating effect. It is planned to repeat the

¹ Contribution number 95 from the Department of Natural Science, Michigan State University.

experiment upon my return from a sabbatical leave, using Mexican species as the subjects.

I also experimented with the acid on several plants of *Camptosorus rhizophyllus* that I had grown from spores. The sporelings had, however, stayed in their "adolescent" stage for many weary months. Spraying the plants with the acid speeded up the growth to a marked degree.

More detailed and precise experiments will be needed to assay fully the use of this acid in fern culture. The acid is still a tool of professional researchers, but I am aware that it is available for retail sale. Some of our members may care to experiment with it.¹

MICHIGAN STATE UNIVERSITY, EAST LANSING, MICHIGAN.

Asplenium adiantum-nigrum in Mexico

ROGERS McVAUGH

In 1888, C. W. Hope, who was familiar with *Asplenium exiguum* Bedd., a common fern of northwestern India, pointed out to fern specialists at Kew that this species was indistinguishable from *A. glenniei* Baker, of Mexico. This identification was accepted by these specialists with some reluctance, partly because "there was a wide interval between Mexico and the western Himalaya."¹ Modern students of floristics and plant-geography now admit without hesitation the existence of similarly disjunct species-ranges, but it is still an open question how the plants have become so widely distributed.

¹ Supplementing Professor Knobloch's account, I may say that gibberellic acid is available under a large variety of trade names, from seedsmen and other stores, including the "five and ten." The products carry a wide range in prices; all have a high percentage of inert material. The acid is also available in pure form from a number of manufacturers of biological substances (for example, Charles Pfizer & Co., 630 Flushing Ave., Brooklyn 6, N. Y.) at \$4.00 a gram, equalling 100,000 doses at 10 ppm. Six months ago the price was \$40.00 a gram.—R.C.B.

¹ Hope, C. W. Note on *Asplenium glenniei* Baker in Synopsis Filicum, 2d Ed. p. 488. Bull. Torr. Bot. Club 26: 58-62. 1899.

The anomalous distribution of *Asplenium exiguum* and several other species of *Asplenium* has been considered by Ewan as perhaps having resulted from the dispersal of spores in air-currents in the stratosphere.² At the time of publication of Ewan's paper in 1945, three species, *Asplenium exiguum*, *A. dalhousiae*, and *A. adiantum-nigrum*, were known to him from limited areas in the southwestern United States but had their principal areas of distribution in Asia or Eurasia. Only *A. exiguum* was known to Ewan to extend its American range southward into Mexico. A few years later, however, the same writer reported the discovery of *A. dalhousiae* at a locality in Sinaloa.³

It is now possible to report the finding of the third species, *A. adiantum-nigrum* L., in southwestern Chihuahua. On March 18, 1951, I collected (my no. 11508) a small species of *Asplenium* that was growing in tufts on north-facing rocky slopes in the pine forest about 18.5 miles east of Guachóchic, Chihuahua (Lat. approximately 26°50' N., Long., 106°56' W.). The elevation above sea level at this point was approximately 2500 meters. I submitted the specimen to my colleague, Dr. W. H. Wagner, Jr., who identified it provisionally as *Asplenium adiantum-nigrum*. I subsequently confirmed this identification by comparison at the United States National Herbarium with specimens from both the Old and New World. Mr. C. V. Morton kindly made the specimens available to me and aided in the comparisons. The Mexican specimens are smaller than the average for the species (the fronds being only 3 to 10 cm. long), but plants of comparable size are not uncommon at the other American localities from which the plant is known. In other respects the plant from Chihuahua agrees precisely with normal specimens of *A. adiantum-nigrum*. Especially characteristic

² Ewan, Joseph. Sources of the Fern Flora of Colorado. *Amer. Fern Journ.* 35: 114-128. 1945.

³ Ewan, Joseph. The discovery of *Ceterach Dalhousiae* in Mexico. *Amer. Fern Journ.* 38: 65-68. 1948.

are the scales of the lower stipe; these are attenuate into long filiform tips with conspicuous but very narrow hyaline margins and a single somewhat zigzag row of dark thickened inner cell-walls. Equally characteristic are the strong sharp ascending teeth of the pinnules and their lobes.

It is of interest to note that the same species was collected by C. G. Pringle (No. 1444) at Arroyo Ancho, Chihuahua, on October 15, 1887. This locality (spelled Arroyo Aucho on the printed label distributed with Pringle's specimens) is near C. Guerrero, about 200 kilometers northwest of the locality at which I found the plant.⁴ Pringle's plants were distributed under the name of *Asplenium pumilum* Swartz. His collection was made the type of a new species, *A. chihuahuense*, by Baker, and was described again as new, under the provisional name *A. dubiosum*, by Davenport. Apparently no one has suggested, heretofore, that Pringle's specimens belong to *A. adiantum-nigrum*.

The nomenclatural history of the American representatives of the latter species may be summarized as follows:

ASPLENIUM ADIANTUM-NIGRUM L. Sp. Pl. 1081. 1753.

Asplenium chihuahuense J. G. Baker, Ann. Bot. 5: 305.

Aug. 1891. Type from Chihuahua, Mexico, *Pringle* 1444 (cited erroneously as 144), presumably in herb.

Kew [K].

Asplenium dubiosum Davenport, Garden & Forest 4: 483. Oct. 14, 1891, *nom. prov.* Type from Chihuahua, Mexico, *Pringle* 1444, in herb. Davenport, presumably now in herb. Gray [GH].

Asplenium andrewsii A. Nelson, Proc. Biol. Soc. Washington 17: 174. 1904. Type from Colorado, *D. M. Andrews*, in the Rocky Mountain Herbarium [RM].

UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN.

⁴ Davis, Helen Burns. Life and Work of Cyrus Guernsey Pringle. pp. 42-44. Burlington, 1936.

Fern Plantings in the Abraham Lincoln Memorial Garden

ARTHUR R. LORD

Extending for over a mile along the south shore of Lake Springfield, within a few miles of the Lincoln Home and the Lincoln Tomb and of reconstructed New Salem, is the most uniquely beautiful and enduring of all Lincoln memorials, the Abraham Lincoln Memorial Garden. It is a memorial in which all who reverence the memory of our great Civil War president may participate personally.

This garden, first conceived by the Springfield Civic Garden Club, was sponsored by the Garden Club of Illinois in 1932. Sixty acres were assigned to the project and Jens Jensen, internationally famous landscape architect, prepared detailed plans, which have been faithfully carried out for more than twenty years. Hundreds of garden clubs (local and state), many Lincoln organizations, and individuals have provided planting materials and most of the work to date.

The site was farm land with only a handful of trees. The initial plantings, starting in 1936, were of trees and shrubs. These are now well grown, so that the underplanting of the wooded areas can now be undertaken. A small, statewide committee has been designated for this underplanting. The undersigned, as the member most keenly interested in ferns, has that planting particularly in mind. The first planting of ferns—650 plants of 11 species—took place April 17 to 19, 1957. Many thousands of ferns should find a congenial home in this garden in the next few years.

The ferns planted in April were purchased rootstalks, mostly dormant, and, while first class material of its kind, not nearly so good as freshly collected or home grown material would have been. Members of the Amer-

ican Fern Society that have fern plantings of their own or that are able to collect ferns in the wild properly may wish to make a personal donation to this great memorial during the next few years. Such contributions should be forwarded (transportation charges prepaid, please!) during the Spring or Fall planting seasons to Mrs. T. J. Knudson, "Gladacres," Springfield, Illinois, the president of the Lincoln Garden Foundation, who devotes most of her waking hours to the garden.

In selecting plants to send, remember that the garden has no rock outcrops and that the soil, while reasonably deep and rich in humus, contains almost no rock fragments. Aside from this, the garden affords suitable habitat for most of the ferns that grow in American woods and fields in this latitude. There are low, wet places, sloping banks of ravines, level areas, and rounded hill crests, wooded and open. Freak ferns and foreign importations are not desired—just native American ferns in their wide diversity of form and foliage.

ROUTE 1, BOX 113, PALOS PARK, ILLINOIS.

Adiantum in Peru: New Species and Combinations

ROLLA TRYON

In the course of preparation of a manual on the ferns of Peru,¹ studies of the genus *Adiantum* have made necessary two new combinations and the description of two new species.

ADIANTUM POIRETHI Wikstr. var. **sulphureum** (Kaulf.)

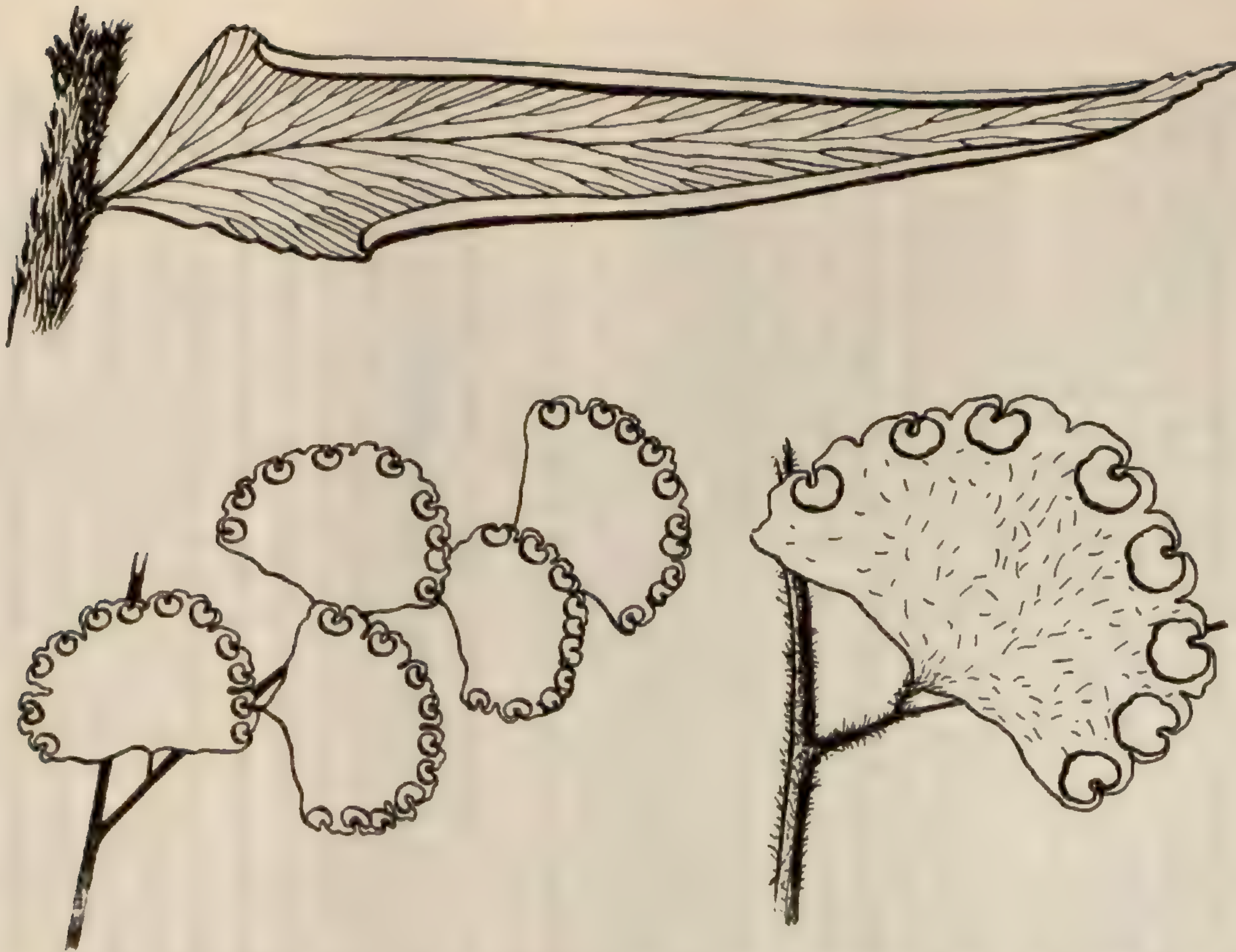
Tryon, *comb. nov.*

Adiantum sulphureum Kaulf. Enum. Fil. 207. 1824.

Adiantum chilense Kaulf. var. *sulphureum* (Kaulf.)

Hicken, Rev. Mus. La Plata 15: 261. 1908.

¹ Supported by a grant from the National Science Foundation (NSF G1064).



ABOVE: *ADIANTUM SCALARE*, A CENTRAL PINNA, THE PUBESCENCE ON THE UNDER SURFACE NOT SHOWN (FROM MEXIA 6162); BELOW: *ADIANTUM IMBRICATUM*, OUTLINE OF AN UPPER PINNA AND A BASAL PINNULE ENLARGED (BOTH FROM BUËS 1305)

ADIANTUM POIRETII Wikstr. var. **hirsutum** (Hook.)

Tryon, *comb. nov.*

Adiantum hirsutum Hook. in Hook. & Grev. Ic. Fil. t. 173. 1830.

Adiantum chilense Kaulf. var. *hirsutum* (Hook.) Hieron. Bot. Jahrb. Engler 22: 396. 1896.

Adiantum Poiretii Wikstr. f. *hirsutum* (Hook.)

Hicken, Rev. Mus. La Plata 15: 261. 1908.

Adiantum Poiretii var. *Poiretii* frequently has yellow wax among the sporangia and this condition grades into the extreme of var. *sulphureum* in which the under surface of the segments is densely covered with yellow wax. Var. *sulphureum* may also have short to moderately long, gland-tipped trichomes, in addition to the wax, and there is a transition from this indument mixture to the extreme of var. *hirsutum* with an abundance of long, gland-tipped trichomes and no wax. For these reasons, as well as the fact that the two varieties are similar in characters other than those of the indument to *Adiantum Poiretii*, it seems appropriate to place them under that species. Probably *Adiantum scabrum* Kaulf. also belongs there but I have not studied it. Although the two variants with indument might be considered to be merely forms, in Peru the few collections indicate that they may have ranges of their own and so represent proper varieties. The relation of *A. Poiretii* and its varieties to *A. chilense* is not entirely clear, but the latter seems sufficiently distinct on the basis of its entire rhizome scales. Those of *A. Poiretii* are freely to rather sparingly ciliate.

ADIANTUM **scalare** Tryon, *spec nov.*

Rhizoma breviter repens. Frondes usque ad 60–75 cm. altas, stipitibus nigrescentibus plus minusve paleaceis rhachidibus similibus paleaceis. Lamina ovata vel oblongo-ovata unipinnata. Pinnae usque ad 8–13 cm. longae elongato-triangulares simplices plerumque auriculatae subtus trichomatibus longis brunneis praeditae, utroque latere solum unicum ferentes.

TYPUS: Río Santiago, Department of Loreto, Peru, *Mexia* 6162 (UC). Isotypes are in the Gray Herbarium, the Missouri Botanical Garden, and the Academy of Natural Sciences, Philadelphia.

This is a distinctive species without evident relationships, although it is probably to be placed in the *A. lucidum*-*A. Poeppigianum* alliance. Other collections that I have seen, both from Peru, are: Río Pichis, Dept. Junín, *Killip & Smith* 26741 (F, GH, NY), and Mouth of Río Santiago, Dept. Amazonas, *Tessmann* 4276 (NY).

ADIANTUM imbricatum Tryon, *spec. nov.*

Rhizoma ignotum. Frondes usque ad 12–30 cm. altas, stipitibus atropurpureis pubescentibus brunneis vel glab-ratis, rhachidibus axibusque similibus pubescentibus. Lamina elongato-oblonga vel elongato-triangularis bipinnata. Segmenta late cuneato-flabellata vel suborbiculata plus minusve symmetrica plerumque imbricata subtus pubescentia; sori rotundi vel orbiculato-reniformes plerumque adjacentes.

Typus: Río Mapillo, La Tranca, Department of Cuzco, Peru, *Bües* 1377 (US). Isotypes at the University of Cuzco (Herb. Vargas), Chicago Natural History Museum, and the Gray Herbarium.

This species is evidently related to *A. Ruizianum* Kl. (*A. Veitchianum* Moore, *A. Steerei* Harr., *A. microsorum* C.Ch.) and to *A. sessilifolium*. From the former it differs in the pubescent segments and axes of the lamina, and the more or less imbricate segments with rather short stalks; the stalk color stops abruptly at the base of the segment. In *A. Ruizianum*, the lamina is glabrous, the segments spaced, with rather long stalks, and the color enters the base of the segment. From *A. sessilifolium* the present species differs in its roundish sori, stalked segments, and glabrous indusia. In *A. sessilifolium* the sori are lunate, many segments are nearly sessile, and the indusia are pubescent.

I am indebted to Dr. César Vargas for the privilege of

examining the ferns in his herbarium, including a large set of the Christian Bües collections, and for making the duplicate specimens of this new species, now at the Gray Herbarium and the Chicago Natural History Museum, available. Other collections that I have seen, also from the Department of Cuzco, Peru, are: La Tranca, *Bües* 1305 (US), and Puente Collopañi, *Bües* 1303 (US).

MISSOURI BOTANICAL GARDEN, ST. LOUIS, MISSOURI.

Observations on Cultivated Ferns, IV. The Species of *Davallia*

C. V. MORTON

The genus *Davallia* has no true "popular" name, although various species are reputed to be called "Squirrels-foot-fern," "Hare's-foot-fern," and "Ball-fern." The scientific name *Davallia* may very well serve, for it is euphonious and easily remembered. The number of species in cultivation in the United States is uncertain; thirteen are listed in L. H. Bailey's *Standard Cyclopedia of Horticulture*, but it is doubtful that so many are really being grown currently, except perhaps in a few botanical gardens.

The plants of this genus are epiphytes (or "air-plants") as they grow naturally in the wild, and consequently they are best cultivated in hanging baskets. They are not difficult in warm regions or in greenhouses, and are to be highly recommended for their graceful form and (usually) evergreen habit, and for their ease of propagation. The elongate, creeping rhizomes, densely covered with brown or whitish ornamental scales, can be broken apart, and the sections will form new plants readily.

Botanically, the species of *Davallia* are not well known. About 80 species are currently recognized in the *Index Filicum*, but there are surely not that many that are really distinguishable. We are grateful to Dr. R. E.

Holttum for pointing out¹ a character of the rhizome scales that will divide the species into two groups. In many species, such as *Davallia denticulata*, the margins of the scales are toothed, the teeth being composed of the marginal cells themselves, each tooth formed from two adjacent cells. Thus the tooth is, so to speak, two-celled at base and has a cell wall for a midrib. Toward the apex of the tooth the dividing wall becomes thinner and is not obvious. Such teeth are mostly a little curved or hooked toward the apex; however, sometimes they are nearly straight, and fairly long—perhaps up to about 0.3 mm. long. The other group of species, as typified by *D. solida*, has entire or subentire scales that are pilose on the margins. The hairs are long, often 1 mm. long or more, and are borne as an outgrowth from a single marginal cell. They are multicellular and have many obvious cross-walls. In dried material at least, they are usually curled and crinkly. These hairs are borne mostly above the middle of the scale, and especially near the apex; they are often deciduous, and are not to be found on old or abraded scales. In fact, in this group of species the whole apex of the scale is apt to fall, leaving only the dark-colored petate bases along the old rhizomes. Sometimes, the pilose-margined scales also have a few two-celled teeth similar to those of the denticulate-margined scales.

The most ornamental species are probably *D. canariensis* and *D. fejeensis*, both of which have finely divided fronds and pilose scales. The Australian *D. pyxidata* is another species of the same alliance. Perhaps these species are not common in cultivation. At least, all the specimens that I have seen from plants sold or cultivated in southern California as *canariensis* or *pyxidata* are *D. trichomanoides*, which is easily distinguished by its much slenderer rhizome, with persistent, brown or whitish, spreading, denticulate scales which are not at all pilose at

¹ In his Ferns of Malaya, in the discussion under *Davallia* and *Humata*.

apex. In scale characters, *D. trichomanoides* is close to *Humata Tyermannii*, which is also in cultivation in the Los Angeles area, perhaps sometimes under the name *Davallia Griffithiana*.² *Humata tyermannii* is extremely similar in vegetative form and perhaps difficult to distinguish in sterile condition. Fertile plants are readily distinguishable by the indusia, which are cuplike in *Davallia*, and merely roundish flaps, attached only at the base, in *Humata*.

KEY TO THE COMMONER SPECIES

Scales of the rhizome toothed and not pilose, the teeth short, each composed of two excurrent marginal cells.

Indusium a roundish flap attached only at the base.

Humata Tyermannii

Indusium cuplike or tubular.

Stipe less than 1 mm. in diameter; blade and primary pinnae acute but not caudate *D. Mariesii*

Stipe 1–1.5 mm. in diameter.

Leaf tissue with striae ("false veins") between the true veins. *D. denticulata*

Leaf tissue without false veins.

Rhizome scales broad (1 mm. wide or more) and gradually tapering to the apex *D. divaricata*

Rhizome scales narrow, and abruptly narrowed above the base. *D. trichomanoides*

Scales of the rhizome bearing long, multiseptate hairs on the margins near the apex, and sometimes a few teeth also.

Rhizome 8–13 mm. thick, covered with persistent, large scales, these with brown bases and centers, and broad pale margins.

D. canariensis

Rhizome thinner, mostly 5–7 mm. in diameter, the scales with a blackish base, which is persistent after the fall of the rest of the scale.

Blades finely divided, the ultimate segments linear and one-nerved. *D. fejeensis*

Blades coarser, the ultimate lobes several-nerved.

Indusium cuplike, barely longer than broad *D. pyxidata*

Indusium tubular, much longer than broad *D. solida*

² The true *D. Griffithiana*, or *Humata Griffithiana*, is a species, similar to *Humata Tyermannii*, that may not be in cultivation.

DAVALLIA MARIESII Moore ex Baker, Ann. Bot 5: 201.
1891.

This species, a native of Japan, has been known in cultivation for many years, but is only just now becoming common. Currently, large numbers of the rhizomes are being imported from Japan, bound up by wires into the form of a monkey, which is intended to be hung up in a greenhouse or porch. They are provided with a small porcelain monkey's head. As they are imported, the rhizomes are barren of leaves, but these appear later, after watering is begun.

DAVALLIA DENTICULATA (Burm.) Mettenius ex Kuhn, Fil.
Deck. 27. 1867; Fil. Afr. 27. 1868.

This is one of the larger and more graceful species. I have seen a cultivated specimen distributed from the Royal Botanic Gardens, Kew, under the name *D. elegans*.

DAVALLIA DIVARICATA Blume, Enum. Plant. Jav. 237.
1828.

Another large and elegant species. The cultivated material that I have seen is from the New York Botanical Garden (*Everett* 134 and 135). It is quite possible that the plants that are listed in Bailey's Cyclopaedia and in Hortus II as *D. pallida* Mettenius are really *D. divaricata*. The true *pallida*, from Borneo and Aneityum, must be an extremely rare species; there are no specimens in the U. S. National Herbarium.

DAVALLIA TRICHOMANOIDES Blume, Enum. Plant. Jav. 238.
1828.

Davallia bullata Wallich ex Hooker, Sp. Fil. 1: 169.
pl. 50. 1846.

As mentioned above, this species has been passing erroneously in cultivation as *D. canariensis*; the differences

have already been mentioned. *Davallia bullata* has usually been considered as a distinct species, but it is reduced to a mere form by Backer and Posthumus³ as forma *barbata* (v. A. v. R.) Backer & Posthumus. Typical *trichomanoides* is said to have light yellow-brown rhizome scales, strongly incised lobes, and sori facing upwardly on distinctly upwardly dilated segments, and f. *barbata* red-brown scales, less strongly incised lobes, and sori on short segments that are only slightly or not at all upwardly dilated, or the sori placed along the margins of larger lobes. The significance of these characters is open to doubt. I have seen specimens from the gardens in Los Angeles of Mrs. Fay MacFadden (*MacFadden* 26870), Lawndale Greenhouses (*B. Joe* 554), A. W. Roberts (*B. Joe* 571), Turner's Shade Gardens (*B. Joe* 509), D. Behrends, and Dr. W. C. Drummond (*Drummond* 42).

DAVALLIA CANARIENSIS (L.) J. E. Smith, Mem. Acad. Turin 5: 414. 1793.

This, the type species of *Davallia*, and the longest known, has the typical "Atlantic" distribution, being found naturally in Grand Canary Island, Teneriffe, Madeira, and Portugal. It is perhaps not common in cultivation except in botanical gardens. I have seen specimens cultivated in the Botanical Garden, Berlin-Dahlem, and in Tangier, Morocco.

DAVALLIA FEJEENSIS Hooker, Sp. Fil. 1: 166. pl. 55d. 1846.

This common and ornamental species is found naturally only in the Fiji Islands, where it is apparently not uncommon. It is probably a local development from the widespread *D. solida*, but appears to me to be a valid species at the present time. I have seen specimens from the New York Botanical Garden, Golden Gate Park, San

³ Varenflora voor Java 101. 1939.

Francisco, the Lake Charm Nursery, Oviedo, Florida, from the gardens of St. Mary's College, Port of Spain, Trinidad, and from the gardens of Mr. L. Graner and Mr. Alfred Roberts, both of Los Angeles, California.

DAVALLIA PYXIDATA Cavanilles, Descr. 278. 1802.

This Australian endemic is perhaps not common. The only cultivated specimen that I have seen is from the Botanical Garden, Bonn, Germany.

DAVALLIA SOLIDA (Forster) Swartz in Schrad. Journ. Bot. 1800, pt. 2: 87. 1801.

The lobes of the fronds of this species are broader than any other species, and the whole aspect is coarse. Consequently, this is not an especially desirable plant for small greenhouses. As it occurs naturally in Polynesia, it is extremely variable, and there are perhaps several distinguishable segregates that could be recognized conveniently. In Los Angeles, it is cultivated by Mr. Alfred Roberts and Mrs. Yolanda Orta, and doubtless by many others.⁴

SMITHSONIAN INSTITUTION, WASHINGTON, D. C.

⁴ From my recollections of about 60 years, the sale of the "ball-fern," *D. Mariesii*, may be reported as of long standing. I do not recall the use of plants formed into other figures. One of the most respected of earlier seedsmen, Dreer and Company, of Philadelphia, offered the "shining davallia" [*D. solida*, under the name *D. lucida*]. Mr. James Clark, manager of the Dreer greenhouses at Riverton, N. J., long a member of the Fern Society, recommended it highly as a house plant. Despite its native epiphytic habit, it was successfully grown in a humus soil mixture in pots. The most distinctive species *D. pentaphylla* is probably still in botanic garden collections.—R.C.B.

Ferns and Fern-allies of the District of Columbia

S. F. BLAKE

Although the pteridophytes of the District of Columbia have been included in three local or regional fern floras published within the last 30-odd years, it is still not possible to draw up from the literature a precise catalog of the species that have actually been found within District limits. W. R. Maxon's list¹ of 1919, despite its title, was essentially identical (except for the omission of *Marsilea*) with the treatment he prepared for Hitchcock and Standley's "Flora of the District of Columbia and vicinity," published in the same year, which covered a radius of about 15 miles around the Capitol and took in adjacent bits of Maryland and Virginia that include some ecological habitats not duplicated in the District. These lists included "56 species" (actually, besides 2 recognized hybrids with specific names, 54 species as interpreted by Maxon, 53 species and 1 variety according to Broun's Index, or 52 species and 2 varieties as here interpreted), as well as two additional hybrids not provided with specific names and (in the D. C. Flora) a single adventive species, *Marsilea quadrifolia*, which was no longer known to occur. However, at least eleven species and three of the hybrids were cited only from named localities outside of the District, and some other species for which the occurrence was less definitely stated also belong in this category. An interesting account of the varied habitats of the District of Columbia region and their characteristic ferns may be found in Maxon's paper in the Fern Journal.

C. F. Reed's "County distribution of the ferns and fern-allies in Maryland, Delaware and District of Colum-

¹ Ferns of the District of Columbia. Amer. Fern Journ. 9: 38-48. 1919.

bia''² definitely lists for the District only 16 species. In the same author's "The ferns and fern-allies of Maryland and Delaware including District of Columbia" (1953, p. 14) the statement is made that the number "is perhaps nearer twenty," but dots indicating definite records for over 30 species are shown on his distribution maps, and in some other cases, where the dot is not clearly indicated as inside the District, there is substantiating material in the U. S. National Herbarium, so that the number of species in the District on the basis essentially of the data given in his own work should be about 40. Dr. Reed informs me that he had in mind only the present or recent occurrence of species in the District, but even so his figure of 20 is much too low. However, I have not been able to verify the local occurrence of two species (*Botrychium matricariaefolium*, *Dryopteris goldiana*) that he indicates by dots.

In view of the indefiniteness of the available lists, it seems worth while to present a catalog restricted to those pteridophytes actually known to have occurred within the present limits of the District of Columbia. This area of 69.24 square miles (about 61 being land) is for the most part thickly settled, and favorable habitats for ferns are few. Although park areas of one sort or another occupy about 15% of the total acreage of the region, the only large area that is still in a fairly thickly wooded condition, affording appropriate habitats for a variety of ferns, is Rock Creek Park. The upper stretch of this park, really the only territory inside District limits that is suitable for many ferns, is about 2.5 miles long and 0.8 mile wide, varying from about 60 to 340 feet above sea level, and is extensively cut up by Rock Creek and the little gullies carved by its occasional tributaries. Unfortunately much of its surface is occupied

² Bull. Nat. Hist. Soc. Maryland 13: 47-54. 1 fig. (map). 1943. (Mimeographed.)

to a continually increasing extent by that worst pest among eastern weeds, the Japanese honeysuckle, *Lonicera japonica*, which quickly smothers practically all herbs and eventually even much of the woody vegetation. Of the 40 native species (31 Filicineae and 9 allies, plus 1 hybrid and 4 adventive species) here reported from the District, over three-quarters have been found in Rock Creek Park, although some of them (*Athyrium pycnocarpon*, *Camptosorus rhizophyllus*, *Dryopteris clintoniana*, *Woodwardia areolata*, and perhaps others) are probably now extinct there. The absence of most of the 8 species that are lacking—these being *Lycopodium inundatum*, *L. tristachyum*, *Isoëtes riparia*, *Ophioglossum vulgatum*, *Matteuccia struthiopteris*, *Pellaea atropurpurea*, *Pteridium aquilinum*, and *Woodwardia virginica*—can be attributed to the lack of suitable habitats, but some of them (at least *Pteridium*, possibly *Ophioglossum* and *Lycopodium tristachyum*) may yet be found in the Park.

The following 14 species (plus 2 hybrids) not known from the District itself have been found in the District of Columbia region, the circle 15 miles in radius with the Capitol as a center: *Lycopodium alopecuroides* L., *L. carolinianum* L., *L. clavatum* L.; *Selaginella rupestris* (L.) Spring; *Isoëtes engelmannii* A. Br. (var. *valida* Engelm.); *Botrychium matricariaefolium* A. Br.; *Lygodium palmatum* (Bernh.) Swartz; *Asplenium montanum* Willd., *A. pinnatifidum* Nutt., × *Asplenosorus ebenoides* (R. R. Scott) Wherry, *Cheilanthes lanosa* (Michx.) D. C. Eaton, *Cystopteris bulbifera* (L.) Bernh., × *Dryopteris boottii* (Tuckerm.) Underw., *D. goldiana* (Hook.) Gray, *D. simulata* Davenp., *Polypodium polypodioides* (L.) Watt (var. *michauxianum* Weatherby).

For assistance in the preparation of this paper I am indebted to James E. Benedict, Jr., R. F. Blasdell, W. Drew Chick, Dr. R. T. Clausen, Dr. G. R. Fessenden,

Dr. F. J. Hermann, Dr. James Kezer, C. V. Morton, P. L. Ricker, Dr. C. F. Reed, Dr. W. H. Wagner, Jr., and Dr. E. T. Wherry.

Pteridophytes of the District of Columbia

EQUISETACEAE

EQUISETUM ARVENSE L.

EQUISETUM HYEMALE L. var. PSEUDOHYEMALE (Farw.) Morton.

LYCOPODIACEAE

LYCOPodium COMPLANATUM L. var. FLABELLIFORME Fern.

LYCOPodium INUNDATUM L. var. BIGELOVII Tuckerm. (including *L. adpressum* (Chapm.) Lloyd & Underw.). Kenilworth and Deanwood, D. C. (1897, 1901).

LYCOPodium LUCIDULUM Michx.

LYCOPodium OBSCURUM L.

LYCOPodium TRISTACHYUM Pursh. Sandy soil on edge of pine-woods, Washington (the exact locality not recorded), 1926, *Blake* 9312 (U. S. Nat. Herb.). This is the sterile, nearly non-glaucous form occurring in woods.

SELAGINELLACEAE

SELAGINELLA APODA (L.) Fern.

ISOËTACEAE

ISOËTES RIPARIA Engelm. var. PALMERI (A. A. Eaton) Proctor f. SACCHARATA (Engelm.) Proctor. Shore of Anacostia River opposite Navy Yard, 1900, E. S. Steele. (Identified by Proctor.)

OPHIOGLOSSACEAE

BOTRYCHIUM DISSECTUM Spreng. Typical form, also var. *obliquum* (Muhl.) Clute.

[BOTRYCHIUM MATRICARIAEFOLIUM A. Br. Collected in Rock Creek Park opposite the Army Medical Center, Bethesda, Montgomery Co., Md., about a mile beyond D. C. Boundaries, 13 June 1943, by Dr. James Kezer (Wiegand Herbarium, Cornell Univ.); and by others in nearby Maryland but somewhat farther from the District line. May yet be found inside District limits in the Park.]

BOTRYCHIUM VIRGINIANUM (L.) Swartz.

OPHIOGLOSSUM VULGATUM L. var. PYCNOSTICHUM Fern.

OSMUNDACEAE

OSMUNDA CINNAMOMEA L. Typical form, also var. *glandulosa* Waters.

OSMUNDA CLAYTONIANA L.

OSMUNDA REGALIS L. var. SPECTABILIS (Willd.) Gray.

POLYPODIACEAE

ADIANTUM PEDATUM L.

ASPLENIUM PLATYNEURON (L.) Oakes.

ASPLENIUM TRICHOMANES L.

ATHYRIUM FILIX-FEMINA (L.) Roth var. ASPLENIOIDES (Michx.) Farw. Common. Var. *michauxii* (Spreng.) Farw. [*A. angustum* (Willd.) Presl] was once collected (1925) in Chevy Chase, D. C., at 39th and McKinley Sts., as a volunteer plant near a house (G. S. Jamieson and E. T. Wherry, in U. S. Nat. Herb.).

ATHYRIUM PYCNOCARPON (Spreng.) Tidestr.

ATHYRIUM THELYPTERIOIDES (Michx.) Desv.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link.

CYSTOPTERIS FRAGILIS (L.) Bernh. R. F. Blasdell, who is studying the variations of this species, reports that one sheet collected by Wherry (Gray Herb.) in Washington in 1927 belongs to var. *mackayi* Lawson, and that the only other sheet available, collected by D. L. Topping (U. S. Nat. Herb.) in 1895 in the Zoological Park (Rock Creek Park) lacks rhizome but agrees with var. *protrusa* Weatherby in aspect and spore size.

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore.

DRYOPTERIS AUSTRIACA (Jacq.) Woyнар var. INTERMEDIA (Willd.) Morton. Single sheet (U. S. Nat. Herb.) labeled District of Columbia, 1884, H. W. Henshaw. Var. *spinulosa* (Müll.) Fiori (*D. spinulosa*). Rock Creek Park, near Piney Branch, 1899, Maxon 190.

DRYOPTERIS CLINTONIANA (D. C. Eaton) Dowell. Formerly at one station in Rock Creek Park, where last observed by J. E. Benedict, Jr., in 1949 (specimen collected by him in 1924, U. S. Nat. Herb.).

DRYOPTERIS CRISTATA (L.) Gray.

DRYOPTERIS HEXAGONOPTERA (Michx.) Christens.

× DRYOPTERIS LEEDSII Wherry (*D. goldiana* × *marginalis*). Valley of Rock Creek near west end of Calvert St. Bridge, 1926, Wherry.

DRYOPTERIS MARGINALIS (L.) Gray.

DRYOPTERIS NOVEBORACENSIS (L.) Gray.

DRYOPTERIS THELYPTERIS (L.) Gray var. PUBESCENS (Lawson) Nakai.

MATTEUCCIA STRUTHIOPTERIS (L.) Tod. var. PENNSYLVANICA (Willd.) Morton. Known as a native only from Theodore Roosevelt (formerly Analostan) Island in the Potomac at Georgetown, where collected in 1955 by Guy L. Michener of the National Park Service (U. S. Nat. Herb.). Has been introduced at Dumbarton Oaks, I am informed.

ONOCLEA SENSIBILIS L.

PELLAEA ATROPURPUREA (L.) Link. Typical form and f. *cristata* (Trel.) Clute.

POLYPODIUM VULGARE L. var. VIRGINIANUM (L.) Eaton.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott. Typical form and f. *incisum* (Gray) Gilbert.

PTERIDIUM AQUILINUM (L.) Kuhn var. LATIUSCULUM (Desv.) Underw.

(PTERIS MULTIFIDA Poir. Small clumps of the non-cristate form in two openings covered with gratings in the sidewalk on 2nd St., N. E., near East Capitol St., Washington, 1956 and 1957, F. J. Hermann 12605, 13588 (U. S. Nat. Herb.). It survived there through at least the winters of 1955-56 and 1956-57. Native of China, often cultivated.)

(PTERIS VITTATA L. F. N. Irving (Amer. Fern Journ. 33: 28. 1943) reports this cultivated Chinese species as surviving for several years outdoors from spores that germinated on the brick foundation of a government greenhouse in Washington.)

WOODSIA OBTUSA (Spreng.) Torr.

WOODWARDIA AREOLATA (L.) Moore.

WOODWARDIA VIRGINICA (L.) Smith.

MARSILEACEAE

(MARSILEA QUADRIFOLIA L. According to Maxon in Hitchcock and Standley (Flora of the District of Columbia and vicinity, Contr. U. S. Nat. Herb. 21: 58. 1919), this was "accidentally introduced in 1880 at Government Fish Ponds [near Washington Monument], since filled; it has perhaps escaped to the river." A letter from Rudolph Hessel, Superintendant of the Carp Ponds, written in 1886 and preserved in the National Herbarium along with specimens of the species collected by W. H. Seaman in the same year, gives the history of the introduction. The plant was first noticed in 1880, about May, in one of the ponds in which Mr. Hessel raised "*Marsilea salontrix*" (presumably *M. salvatrrix*) received a couple of months before from Munich packed in moss, and he suspected that the conceptacles of *quadrifolia* had been in the same package. By August it had spread over 10 or 12 square

feet in the Idus pond, at which time he received more of the same species from the Harvard Botanical Garden. The "*M. salontrix*" disappeared in the cold winter of 1880-81 but the *quadrifolia* persisted and became so harmful to other vegetation that he attempted to destroy it. "The west pond 6 years ago was an open water and there came some conceptaculas perhaps through the drain pipe of the Idus pond, when this pond was cleaned out from there farther out to the Potomac, where they were found lately from [sic] the botanists." The last statement is evidently the basis for the suggestion in the District Flora that "it has perhaps escaped to the river," but there is no specimen to support it in the National Herbarium. Whether it persisted after 1886 we have no means of knowing, but it has been extinct for many years. The fact that it was unintentionally introduced and persisted and spread to some extent for at least half a dozen years entitles it to mention as an adventive plant, but it is of course not a countable element in the D. C. flora.)

SALVINIACEAE

(*AZOLLA CAROLINIANA* Willd. Established at Kenilworth Aquatic Gardens, 1950 (*F. J. Hermann* 11659; U. S. Nat. Herb., U. S. Nat. Arb.).)

PLANT INDUSTRY STATION, BELTSVILLE, MARYLAND.

Recent Fern Literature

LEHR, J. HARRY. AN ANNOTATED PRELIMINARY CATALOGUE OF THE VASCULAR FLORA OF ROCKLAND COUNTY, NEW YORK.—In a first installment of this Catalogue,¹ Mr. Lehr deals with the ferns of Rockland County, the County across the Hudson River from Westchester County. It has some 1700 square miles, and is undergoing rapid "suburbanization" due to its nearness to New York City. The main objective of this Catalogue is to set down accurate records of the plant species of the county before further destruction of the original native flora has taken place. Besides the changes that advancing civilization is bringing about, Mr. Lehr reports that the County flora has had relatively little earlier floristic study; plant collections and records are scanty.

¹ Bull. Torrey Bot. Club 83: 435-438. 1956.

From the standpoint of fern students, the list offers several points that seem worth noting. Out of the total of 44 named species (excluding subspecific taxa) listed, it is stated that for more than one third this is "the first definite record." The total of 44 is of interest when compared with the list of 78 species reported for the adjoining state of New Jersey by Chrysler and Edwards.² Although much of this disparity can be accounted for by the much larger area of the state and its much greater diversity in topographic features and habitats, there is still a wide difference in numbers of fern types when only the areas of New Jersey contiguous to Rockland County are considered. Mr. Lehr lists four species and two varieties of *Botrychium* in Rockland but does not include two of the little species, *simplex* and *lanceolatum*, for which there are numerous reports for the adjacent New Jersey counties. Of the species listed for the polypody family, broadly interpreted, several for which frequent collections are indicated in nearby New Jersey do not appear in the Rockland list, e.g., three spleenworts, *Pellaea glabella*, and *Cystopteris bulbifera*. The greater extent of limestone areas in New Jersey may account for the frequency of the five preceding species, but it would not explain the absence of *Woodsia ilvensis* in Rockland County. Unless the natural wild areas of Rockland have become too extensively "civilized," it seems likely that the more extensive study Mr. Lehr proposes will turn up a fair number of the missing species. From my own field experience in northern New Jersey and in the parallel areas of western Connecticut, I should expect that the present lone collection of *Dryopteris Boottii* may be multiplied several times. In this connection, however, neighboring areas of New Jersey may offer a precedent for what is taking place in Rockland County: Some of the formerly most prolific stations for several *Dryopteris* hybrids—West Engle-

² Ferns of New Jersey. 1947.

wood, for example—no longer harbor even the parent species.

One other point: In an attempt to promote standardization of English names for the fern species, Mr. Lehr has adopted one such name for each type. I am heartily in favor of the objective, although I differ with respect to a few of the names chosen. The use of “shield fern” for *Dryopteris* seems to me much less desirable than the name “wood fern,” which has in its favor the classic D. C. Eaton volumes, and the more recent usage of Standardized Plant Names in which it was supported by a committee consisting of W. R. Maxon, C. A. Weatherby, and C. V. Morton. All but the fragrant fern of our species of this genus are wood denizens. The term “shield” refers to the indusium which is not really shield-shaped but kidney-shaped, whence the German name Nierenfarn [“kidney-fern”] for *Dryopteris*.³ An added point is found in the British use of “shield fern” for *Polystichum*. —R. C. BENEDICT.

“A Manual of Aquatic Plants,”¹ is available again in a revised edition that the author unfortunately did not live to complete. The area covered is from the Gulf of St. Lawrence south to Virginia and west to Minnesota and Missouri, approximately the Gray’s Manual range. Aquatic ferns are few and far between, consisting chiefly of *Marsilea*, *Azolla*, and *Salvinia*. However, the fern-allies *Equisetum* and *Isoëtes* contain a number of aquatic species, and these are treated and illustrated by Dr. Fassett. The enlarged drawings of the quillwort spores will be useful in the identification of material.—C. V. M.

³ Although, as it seems from Hegi, in Germany also the name Schildfarn [“shield-fern”] is commoner. [Ed.]

¹ By Norman C. Fassett. Revised edition, with appendix by Eugene C. Ogden. pp. 1–405. *illus.* University of Wisconsin Press, Madison, Wisconsin. 1957 (\$6.50).

Notes and News

MEMBERSHIP GROWTH AGAIN.—The rapid growth of the American Fern Society was noted in the last number of the Journal, and now, as will be noted on the last pages of this number, we have the largest number of new members yet—55 in the last three months. These new members were largely gained through an article on growing ferns from spores in the August issue of *Sunset Magazine*. We welcome these new members and trust that they will find material of interest in the Fern Journal and valuable contacts among the other members of the Society. The next number of the Journal will contain a non-technical article on growing ferns from spores; and the new membership list now in preparation should assist members in making new contacts.—C. V. M.

NEW CURATOR AND LIBRARIAN.—Because of his move from the Missouri Botanical Garden, Dr. Rolla M. Tryon, Jr., felt obliged to resign as Curator and Librarian. The Society is exceedingly grateful to Dr. Tryon for his services during the last ten years. The Council has appointed Dr. Warren H. Wagner, Jr., Department of Botany, University of Michigan, Ann Arbor, Michigan, as the new Curator and Librarian. Members wishing to borrow specimens from the herbarium or books from the library should correspond with Dr. Wagner.

INTERNATIONAL BOTANICAL CONGRESS, FIRST NOTICE.—The Ninth International Botanical Congress will be held in Montreal, Canada, from August 19 to 29, 1959, at McGill University and the University of Montreal. The program will include papers and symposia related to all branches of pure and applied botany. It is not too early for Fern Society members to make plans to attend, and especially to begin to prepare papers for delivery at the meetings. There will undoubtedly be several meetings for fern papers, and several field-trips, probably to the Hudson's Bay area, Labrador, and other parts of Canada. A first circular giving information on program, accommo-

dation, excursions, and other details will be available early in 1958. This circular and subsequent circulars, including application forms, will be sent only to those who write to the Secretary-General asking to be placed on the Congress mailing list: Dr. C. Frankton, Secretary-General, IX International Botanical Congress, Science Service Building, Ottawa, Ontario, Canada.

March 11, 1957

Dear Mr. Morton:

Your name and address were given to me by Mrs. Gee of the American Begonia Society. I also note you are like myself a member of the British Pteridological Society, being the reason for this letter. Although I am a keen grower of hardy ferns, I have a deeper interest in the greenhouse species, which have disappeared from all growers' lists and have become very rare over here. Could you put me in touch with anyone in the United States who is a grower of these, with a view to exchanging seeds and so forth. Unfortunately we have very little in the way of fern spores, but I can supply seeds of double begonias, carnations, and other seeds. I am endeavoring to get together a collection of *Adiantums*, including the pink-tinted varieties, ferns coated with farinaceous powder, and *Selaginellas*. Of these I have only a few. I am erecting a new section to my greenhouse for the purpose of housing my ferns. Hoping you can assist me,

I remain,

Yours faithfully

G. French, 28 Salcot Crescent, New
Addington, Croyden, Surrey, England

American Fern Society

Report on the New England Field-trip

The New England Committee of the American Fern Society planned and carried out a very enjoyable field-trip in the vicinity of Rutland, Vermont, on July 12 and

13, 1957. Aside from the work of the New England Committee, the success of the meetings was due to the expert guidance of Mr. Henry Potter, a local farmer-naturalist, whose accession as a new member was a welcome event. The headquarters for the trip was the Wallingford Inn, Wallingford, Vermont, and from there the group as a whole or parties took off to explore the following areas:

On Friday, July 12, we went to Proctorsville Gulf where a profusion of ferns on both sides of the road yielded 27 species, including *Polystichum Braunii* and *Athyrium pycnocarpon*, rare in this region. Lunch at the White Rocks Picnic Area added one thrill for Mrs. Percy Adams, who arrived ahead of the group and saw a black bear walk across the road in front of her car and through the picnic area.

In the afternoon Pitcher Mountain in Clarendon was explored by 24 of the group, and eight species of ferns were added to the morning's count. High up on a cliff a few hardy climbers located *Pellaea atropurpurea* and *Asplenium Ruta-muraria*, while others on hands and knees found many specimens of five small grape ferns (*Botrychium dissectum*, *B. lanceolatum*, *B. matricariifolium*, *B. multifidum* and *B. obliquum*) as well as the larger *B. virginianum*.

The evening was spent marvelling at Charlie Neidorf's beautifully mounted and expertly photographed ferns (displayed in the hotel lobby) and in viewing some of Maurice Broun's color slides of ferns as shown by Miss Helen Bristow.

On July 13, 31 people, a pet fox, and a boxer tramped for an hour through mossy woods and by a mountain brook in Sugar Hollow for a sight of a remarkably southern station of *Dryopteris Filix-mas*. This was found at the entrance of cool, moist caves opening into an old silver mine. *Dryopteris austriaca* was growing in the area also at the low altitude of 1000 feet, and on the ledge above

was found *Cryptogramma Stelleri*.

In the afternoon the group split into two parties, one party searching rocky mountain areas and adding nothing new to the list, while the rest explored a quaking bog near Wallingford and found more than 19 types of bog-plants including *Lycopodium inundatum* and three orchids—Calopogon, Rose Pogonia, and one of the Habenarias.

The scheduled activities of the group were concluded with an informal meeting Saturday evening in which Dr. Benjamin Allison, as Master of Ceremonies, called on several members to speak briefly to the group on their fern experiences here and abroad. Dr. Ralph Benedict, former President and long-time member of the Fern Society, gave glimpses from the activities of the Fern Society over the past 60 years. Mr. Boughton Cobb, author of the recent book "A Field Guide to the Ferns" spoke briefly on a comparison between American and British ferns. He said, "We saw as many species yesterday as in the whole of Britain." Dr. Edward Chapin, formerly of the National Museum in Washington, spoke on tropical lycopodiums. Ours, here in the northeast, are all terrestrial, but the tropics have many more species, most of which are epiphytes. Mr. George Peters gave as his most exciting fern experience the finding of *Cryptogramma crispa* (Parsley Fern) on a mountain at an elevation of 13,000 feet.

Forty-four members and friends attended for part or all of the two days and a total of 43 species of ferns, five species of *Lycopodium* and three species of *Equisetum* (see attached list) were located by various members of the group. The group consisted of several experts, many ferners with some experience, and a number of beginners, all of whom seemed to feel well repaid for the time spent, since 43 of the possible 73 species of ferns to be found in the northeast is a good percentage for two days of ex-

ploration in a limited area.¹

The following persons were present: Mrs. Percy W. Adams, Dr. Fred Allen, Dr. and Mrs. Benjamin R. Allison, Miss Katherine Bacon, Dr. Baggs, Dr. Ralph C. Benedict, Miss Brewster, Miss Alice Bristow, Miss Helen Bristow, Mr. and Mrs. Maurice Broun, Mrs. Muriel Brown, Dr. and Mrs. Edward Chapin, Mr. Boughton Cobb, Mrs. Stewart Coleman, Mr. and Mrs. Cyrus Darling, Mrs. E. J. Dorn, Dr. and Mrs. Arthur W. Doubleday, Mr. and Mrs. Burton Duzendorf, Miss Laura East, Mr. and Mrs. Gordon Foster, Mrs. John Gallagher, Mrs. George M. Gardner, Mrs. Henry Kincaid, Mr. and Mrs. George Peters, Mr. Henry Potter, Mrs. S. G. Prentiss, Mrs. Marion Rhodes, Skippy Rhodes, Miss Anna E. Scudder, Mr. and Mrs. White, Mr. Grover Wright, Mrs. Grace Zelle and party of three. A total of 10 new members joined the Fern Society as a result of the work of Dr. Allison's Committee.

The following ferns and fern-allies were seen on the trip: *Adiantum pedatum*, *Asplenium platyneuron*, *A. Ruta-muraria*, *A. Trichomanes*, *Athyrium angustum*, *A. angustum* var. *rubellum*, *A. pycnocarpon*, *A. thelypteroides*, *Botrychium dissectum*, *B. lanceolatum*, *B. matricariifolium*, *B. multifidum*, *B. obliquum*, *B. virginianum*, *Camptosorus rhizophyllus*, *Cryptogramma Stelleri*, *Cystopteris bulbifera*, *C. fragilis*, *Dennstaedtia punctilobula*, *Dryopteris austriaca*, *D. Clintoniana*, *D. cristata*, *D. Filix-mas*, *D. Goldiana*, *D. intermedia*, *D. marginalis*, *D. spinulosa*, *Matteuccia Struthiopteris*, *Onoclea sensibilis*, *Osmunda cinnamomea*, *O. Claytoniana*, *O. regalis*,

¹ The actual number depends on what is meant by "northeast" and also to some extent on taxonomic differences of opinion. The whole of the northeastern United States and adjacent Canada has 86 species of ferns according to the Eighth edition of Gray's Manual and 79 according to the New Britton and Brown Illustrated Flora [excluding "fern-allies"]. The state of Vermont has 53 species of true ferns according to Blake (Amer. Fern Journ. 40: 164. 1950), and consequently the number found on this field-trip [43] is a high percentage (about 80%) of all those known from the state. [C.V.M.]

Pellaea atropurpurea, *Polypodium vulgare*, *Polystichum acrostichoides*, *P. Braunii*, *Pteridium aquilinum*, *Thelypteris Dryopteris*, *T. noveboracensis*, *T. palustris*, *T. Phegopteris*, *Woodsia ilvensis*, *W. obtusa*, *Equisetum arvense*, *E. hyemale*, *E. sylvaticum*, *Lycopodium clavatum*, *L. complanatum* var. *flabelliforme*, *L. inundatum*, *L. lucidulum*, *L. obscurum*.—ANNA E. SCUDDER.

NEW MEMBERS

- Mrs. Esther Abbott, Route 2, Box 2127 A, Red Bluff, Calif.
 Mrs. Elisabeth Aeschliman, 77 Myrtle Avenue, Montclair, New Jersey
 Mrs. Beryl Allen, 7006 Nebraska Avenue, Tampa 4, Florida
 Mr. Lloyd Allen, 9601 Occidental Road, Sebastapol, Calif.
 Mr. Ralph R. Barton, 517 East Alder St., Brea, Calif.
 Mrs. Malcolm Brown, P. O. Box 127, Ryderwood, Washington
 Mrs. Ruth Busfield, Monroe, Washington
 Mr. O. R. Cedarholm, Jr., 2344 Hanover St., Palo Alto, Calif.
 Mrs. Kenneth L. Clarke, 261 North Orange St., Orange, Calif.
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 Mr. George A. Connell, 630 Shatto Place, Los Angeles 5, Calif.
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 Mr. Dara E. Emery, 2005c Alameda Padre Serra, Santa Barbara, Calif.
 Mrs. Dewey H. Ewers, 2615 Ocean Beach Drive, Longview, Washington
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 Mr. George E. Freeman, 1675 Garnet Lane, Concord, Calif.
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 Mr. Alfred H. Gilbert, Dorset, Vermont
 Mrs. Inez Hazeltine, Oakdale Drive, Box 82 B, Austin, Texas
 Mr. Walter J. Haupt, 117 West Adalee St., Tampa 3, Florida
 Mrs. Ruth Howe, 5240 Noble Avenue, Van Nuys, Calif.
 Mr. Arthur J. Iler, 2444 Hermosa Ave., Hermosa Beach, Calif.
 Mrs. Henry Ketel, 783 South Shore Drive, Holland, Michigan
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- Miss Ramona Oppel, P. O. Box 145, Rio Nido, Calif.
- Mrs. Mamie M. Peterson, 1247 Castro St., Hayward, Calif.
- Mr. R. G. Pfau, Lazy Z Ranch, Pala, California
- Mrs. Tina Prather, 590 Temple Hills Drive, Laguna Beach, Calif.
- Miss Winona M. Richmond, 324 River St., Santa Cruz, Calif.
- Mrs. Charlotte Ritter, 17109 Burton St., Van Nuys, Calif.
- Mr. Roy A. Robinson, 720½ Ocean View, Monrovia, Calif.
- Mr. John B. Rogers, 4316 Stewart Ave., Los Angeles 66, Calif.
- Mrs. Clifford Rudine, 39 San Carlos Ave., Sausalito, Calif.
- Mr. Manford L. Samuelsen, 25 Mariposa Avenue, Los Gatos, Calif.
- Mr. William E. Schmidt, 355 Lambert Avenue, Palo Alto, Calif.
- Mr. A. J. Schwarz, 2509 East 170, Seattle 55, Washington
- Mrs. Donald H. Short, 1801 San Antonio Ave., Berkeley 5, Calif.
- Mrs. Walter Simpson, 22 Prospect St., New Hartford, Conn.
- Mrs. E. J. Smith, 3800 East 57th St., Maywood, Calif.
- Mrs. Paul M. Smith, 4315 West 174th St., Torrance, Calif.
- Mrs. Elihu E. Suits, 172 South Santa Cruz St., Ventura, Calif.
- Mrs. William W. Swan, 3630 Coliseum St., New Orleans 15, La.
- Mr. T. M. Tillson, 3114 West 77th St., Los Angeles 43, Calif.
- Mrs. W. Roy Vernor, 409 Leverin Avenue, Modesto, Calif.
- Mr. C. L. Webber, 685 Candalaria Boulevard, Salem, Oregon
- Mrs. A. J. West, 2833 Puesta Del Sol, Santa Barbara, Calif.
- Mr. Harry Wheeler, 726 Valley View Ave., Monrovia, Calif.
- Mrs. Marie Zachau, 603 East Kelso St., Inglewood, Calif.

CHANGES OF ADDRESS

- Mrs. Okra J. Breidenbaugh, R. R. 3, Bright, Ontario
- Mr. R. M. Giesey, 2707 Channing Road, Columbus 21, Ohio
- Mr. E. M. Shields, 1249 South Basin Lane, Sarasota, Florida
- Mrs. Alice F. Tryon, Department of Botany, University of California, Berkeley 4, California
- Dr. R. M. Tryon, Jr., Department of Botany, University of California, Berkeley 4, California

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ERRATA

- Page 9, line 4: For "*P. arguta*," read "*P. dentata*."
 Page 65, line 3: For "Collier County," read Dade County."
 Cover Vol. 47, no. 2, Table of Contents, line 6: For "*thalictroides*," read "*pteridoides*."
 Page 67, running head at top of page: For "*thalictroides*" read "*pteridoides*."
 Page 68, legend for plate: For "*thalictroides*," read "*pteridoides*."
 Page 69, running head at top of page: For "*thalictroides*," read "*pteridoides*."
 Page 70, legend for figure: For "*thalictroides*," read "*pteridoides*."¹

¹ These unfortunate errors of printing *thalictroides* instead of *pteridoides* are an editorial mistake, and are by no means the fault of Dr. DeVol. Subscribers to the Journal are urged to make the indicated corrections in order to avoid future confusion.